SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LIV.—No. 12. [NEW SERIES.] NEW YORK, MARCH 20, 1886. [$3.20 per Annum. [POSTAGE PREPAID.]

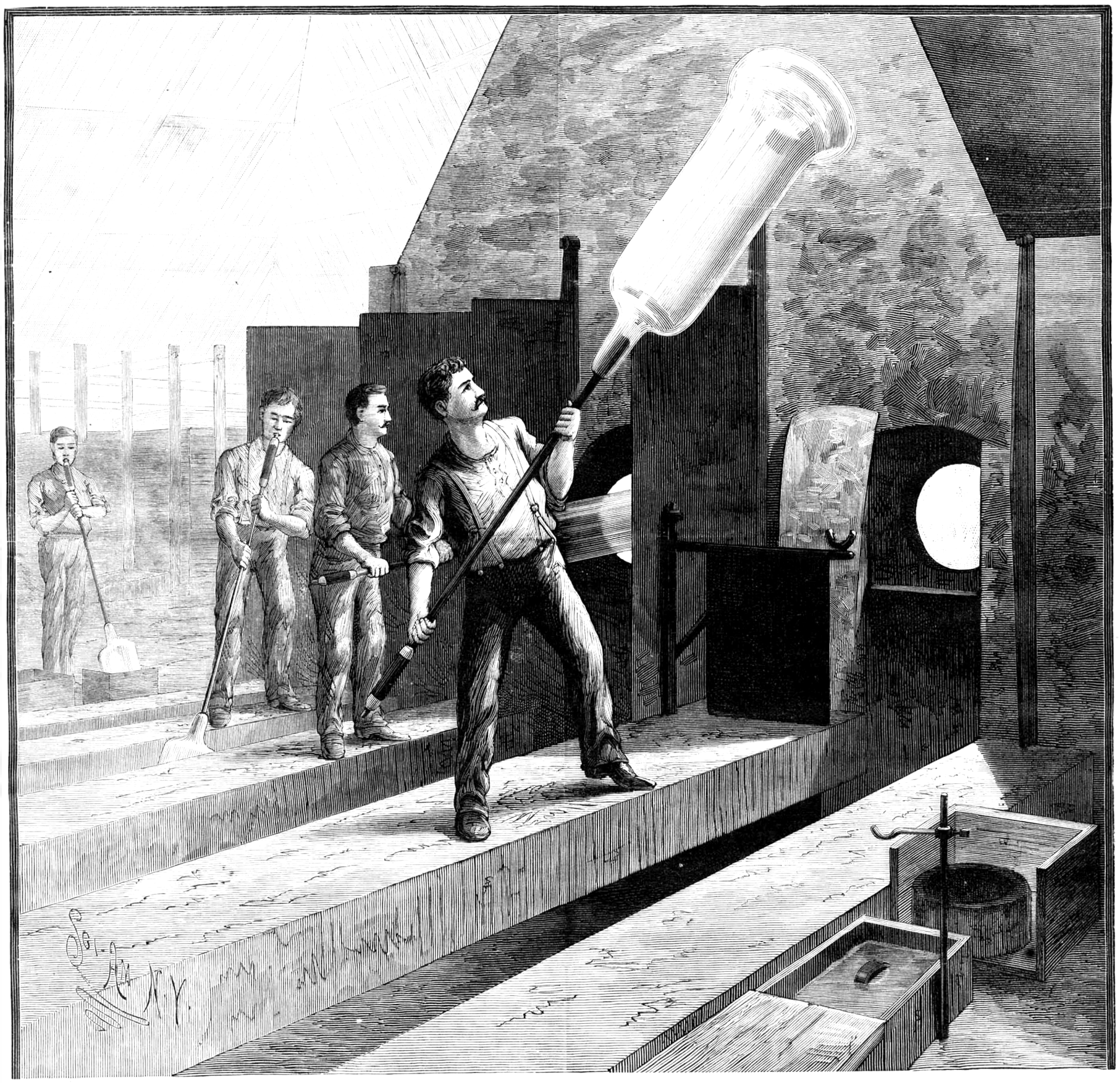
THE MANUFACTURE OF WINDOW GLASS WITH NATURAL GAS.

There is probably no industry among the many that have been benefited by the utilization of natural gas in which the results have been so marked as in the manufacture of glass. For a number of years past, American glass has been undoubtedly inferior to the product of European factories, and has consequently occupied but a secondary position in the estimation of American builders and architects. The foreign manufacturers, and particularly those of France and Belgium, have hitherto manifested a superior dexterity in the handling of their materials. They seem to have held the secret of either neutralizing the effect of impurities in their fuel, or of burning it in such a manner as to get the minimum disadvantage from their presence. This has been due partly to greater experience in the industry and partly to a better construction of furnaces. In some of the more perfect plants, crude fuel has been abandoned and manufactured gas used instead, thus giving them in advance the advantages of natural gas, with the important exception, however, of its cheapness and almost total freedom from sulphur. These circumstances made imported glass synonymous with best quality.

That these conditions have now so far changed that our own glassmakers can compete with the best foreign producers, and can even honestly claim certain points of superiority for the home product, is a subject for hearty congratulation. The improvement has been effected, in a measure, by the more complete mechanical appliances now at our command, but the most potent influence must be ascribed to the use of natural gas. In the manufacture of window glass, the results have been particularly gratifying, many important buildings being now fitted with American glass which but a few years ago would have demanded the imported. The metamorphosis of the crude material into a clear and brilliant pane of glass involves so many interesting points that we have illustrated the process, choosing the works of Messrs. S. McKee & Co., at Pittsburg, as a typical establishment.

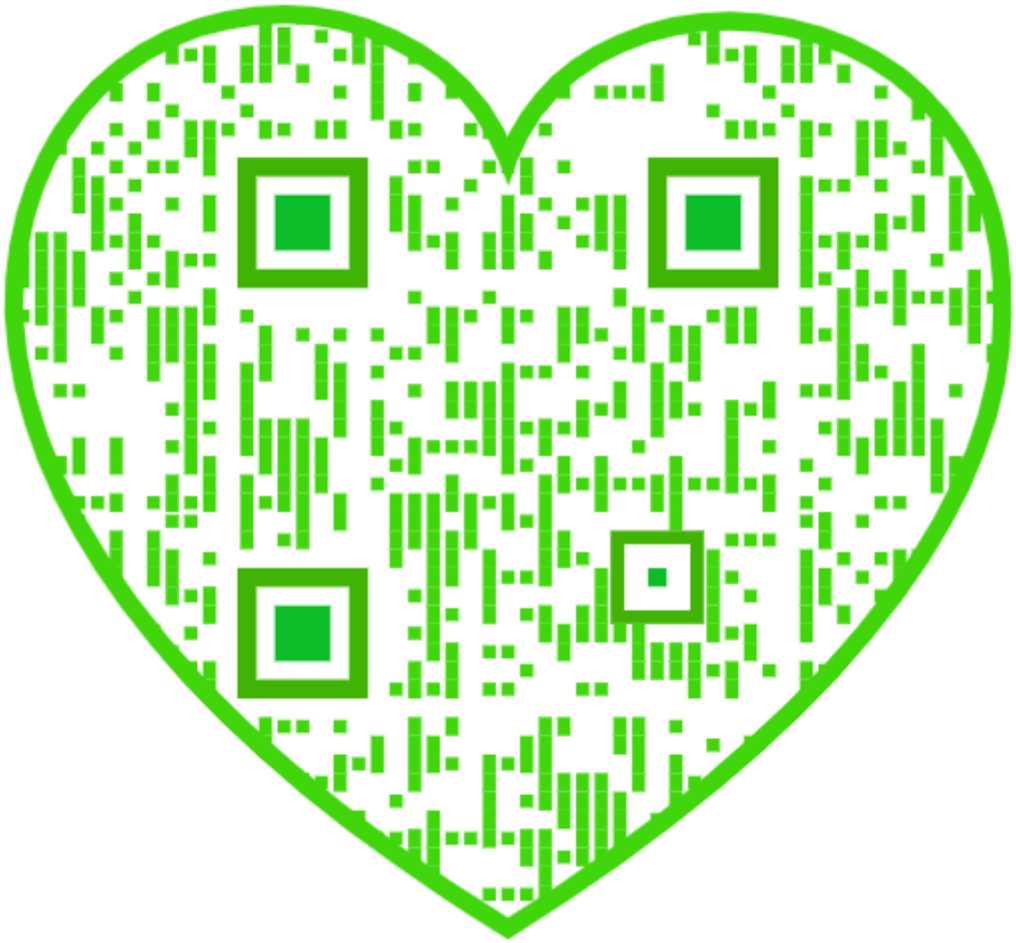
The manufacture of sheet glass depends for its success upon the closest attention to details, and its history is therefore one of delicate manipulations. It is a very easy matter simply to make glass, for it is nothing more than a double silicate of soda or potash and an

(*Continued on page* 183.)



THE MANUFACTURE OF WINDOW GLASS WITH NATURAL GAS.—BLOWING.

© 1886 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal or express money order. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses as desired.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, MARCH 20, 1886.

Contents.

(Illustrated articles are marked with an asterisk.)

Air machines, cold, new use for.. 176
Alcohol, fatal effects of..... 176
Bayonets and cavalry swords, testing*..... 179
Boilers, steam, keeping clean, 181
crude rock oil for..... 181
Books and 186
Bricks, New York..... 181
Business and personal..... 186
Butterflies, longevity of..... 180
Camellia, fluid extract of..... 176
Cans, handle for*..... 173
Capital, idle, too much..... 176
Carriage, steam, Bollee's*..... 185
Chemistry, relation of the Government to..... 184
Copper and nitrogen, combustion of..... 182
Curves traced by vibrating rods.* 180
Decisions, recent..... 181
Digestion, influence of hot drinks on..... 180
Drummers, tax on, unconstitutional..... 184
Electric light in the British Navy 180
Exhibition, proposed American, in 1886..... 176
Fat, lanoline and cholesterine.... 184
Fires, the origin of..... 182
Fish, poisonous, at Rotuma..... 181
Fishes, frozen..... 176
Glass, window, manufacture of with natural gas*..... 175, 183
Heat from incandescent lamps.. 181
Horses, shying..... 180
House, how a wise man built his. 177
House, summer, design for*..... 182
Illumination, a peculiar..... 177
Injector, Gresham's..... 184
Inventions, agricultural..... 186
Inventions, engineering..... 186
Inventions, index of..... 187
Inventions, miscellaneous..... 186
Lathe, screw cutting, improved* 179
New 186
Nebula, new, discovery of a, by photography..... 182
Notes and queries..... 187
Photographic notes..... 177
Pont Neuf, accident to the..... 177
Pruning implement*..... 178
Quicksilver production and trade, 1885..... 177
Rainfall, diminished..... 181
Rose culture, guide to..... 180
Sandpaper, use of..... 185
Saw tooth, Wilson's*..... 178
Screw cutting and automatic sliding gap lathe*..... 179
Sea, light at the bottom of..... 181
Ships, steel..... 185
Snow, plow, improved*..... 178
Soda, California..... 185
Surgery, electrical..... 185
Swords and bayonets, testing*.... 179
Teeth, extracting with the pistol 180
Telegraph instrument, the diamond learner's*..... 180
Telemeter, the Universal..... 177
Thorn clipper, Brown's*..... 178
Toads as bee eaters..... 180
Vibrating rods, microscopic observation of*..... 180
Water works, automatic*..... 178
Wheat production, the cost of... 177
Window glass, manufacture of*.. 175

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 588

For the Week Ending March 20, 1886.

Price 10 cents. For sale by all newsdealers.

PAGE

I. CHEMISTRY, ETC.—Detection of Adulteration of Olive Oil.—By A. AUDOYNAUD..... 8511
A Theory of the Connection between the Crystal Form and the Atom Composition of the Chemical Compounds.—A paper read before the British Association by WM. BARLOW.—16 figures..... 8512

II. ENGINEERING AND MECHANICS.—Amount of Horse Power used in propelling Street Cars.—A paper read by A. W. WRIGHT before the Western Society of Engineers..... 8500
Sibley College Lectures.—On Steam Boilers.—By J. M. ALLEN.—Steam the great motive power.—The horizontal tubular boiler.—Boiler making.—Fractures.—Bracing of boiler heads.—Staggering of tubes.—Sediment and scale.—Explosion..... 8510
The Permissible Strain upon Brickwork.—By Dr. BOHME..... 8511

III. TECHNOLOGY.—Roman Carpentry.—By Prof. HOSKING..... 8506
Manufacture of Artificial Gems.—By HERMAN REINBOLD..... 8507
The Pandiscope or Lantern Sketcher and the "Presto" Photographic Slide Carrier.—3 figures..... 8508
Tin.—Physical properties.—Permanence of polish.—Tin foil.—Tinning copper.—Disintegration of tin..... 8511

IV. ART AND ARCHITECTURE.—Design for a Monument.—By KLOTZ.—With engraving..... 8503
Artistic Bronze Casting.—A lecture by GEO. SIMONDS.—Sculptor's first sketch.—Full-sized study.—Moulds.—Process of piece moulding.—Waste wax process.—Pouring the bronze.—The furnace..... 8503
Harlow Vicarage, Essex.—An engraving..... 8507
Design for a Village Church Organ, by CHIPPENDALE..... 8507

V. ASTRONOMY, ETC.—The Micrometer Threads and Wires of Astronomical Telescopes.—3 figures..... 8508
The Story of Biela's Comet.—By H. A. NEWTON.—A lecture delivered at the Sheffield Scientific School of Yale College.—13 figures 8516

VI. NATURAL HISTORY.—Uneducated Reason in the Cicada.—By J. S. NEWBERRY.—With engraving of a tube formed by pupa of cicada..... 8578

VII. PHYSIOLOGY, ETC.—Sight for the Blind.—Application of an artificial cornea.—4 figures..... 8514
Stunning and Burn by an Electric Lamp.—By GEO. BUCHANAN.. 8514
Fireproof Individuals.—Fire eaters.—Volatile liquids.—Fireproof clothing..... 8515

VIII. MISCELLANEOUS.—Progress of the Telegraph in China..... 8511

IX. BIOGRAPHY.—Sir ROBERT S. BALL, F.R.S., Astronomer Royal of Ireland.—With portrait..... 8508

TOO MUCH IDLE CAPITAL.

There are in the city of New York forty-five national banks with a capital aggregating forty-five million four hundred and fifty thousand dollars. The statement made by these institutions on the first of March showed that there was due to their depositors two hundred and nine million seventy-one dollars. Add to this enormous sum the millions in the vaults of the banks organized under our State laws, and with private bankers, as well as the great sums held by our Trust and Insurance companies, and it is evident that there is a great deal too much unemployed capital lying idle in this city.

If this large sum and the surplus funds in our other monetary institutions throughout the country could be put into circulation, it would give an impetus to all kinds of business, and bring about that condition of prosperity for which the public have been looking for the past few years, and are now realizing only in part.

PROPOSED AMERICAN EXHIBITION IN 1889.

It was in the year 1789 that the Constitutional Government of the United States was established, with Washington as its Chief Executive. The inauguration of the first President was celebrated in the city of New York. As this ceremony ushered in what will probably always be regarded as the greatest century vouchsafed to the nation, it has seemed highly fitting that its centennial should be commemorated by suitable observances in the same city which saw the birth of the new republic. It has therefore been proposed by the General Assembly of the State of Tennessee that such a celebration should be held in 1889 in the city of New York, and that it should take the form of a great National and International Exhibition of Science, Art, Industry, Manufactures, and the Agricultural, Mineral, and other resources of the United States, since this would seem to be the most fitting memorial of the intellectual and material progress made by a young people under a century of popular government.

The joint resolution passed by the Tennessee Legislature provides that such an exhibition shall be recommended; that its importance be commended to the President, with the request that he bring it to the attention of Congress, that the people of Tennessee be urged to assist the movement, and take steps to prepare a suitable State exhibit; and finally, that the Governor be requested to forward a copy of the resolution to the President and to the Governors of the several States and Territories. The occasion is one of such great historical importance, and the celebration proposed seems so eminently suitable, that we trust the movement started by the patriotism of Tennessee will receive the undivided support of her sister States and Territories, of the National Government, and of the President. Three years have already passed since this proposition was first brought forward. Three years remain in which to act. The history of former exhibitions shows that this time is not so long that any of it can be wasted. This should be particularly borne in mind when the importance of the occasion, as well as the competition offered by other exhibitions already organized, both demand that the attractions shall be greater than ever before if the celebration is to be such a success as will satisfy the national pride.

Fluid Extract of Camellia.

Within the space of a few months, Dr. E. R. Squibb has called the attention of the medical profession to the fluid extract of camellia, or tea, which has been thus proposed to take the place of guarana and coca. He states that the testimony in regard to the effect of tea, coffee, Paraguay tea, and kola nuts is all of a similar character to that given with regard to coca. Each of these substances appears to have come into use independently in widely separated countries, in order to produce the same effects, namely, to refresh, renew, or sustain the physical and mental organism; and it is a curious surprise to find that after they had been in use for a very lengthened period, and although each came from a different order of plants, the same active principle, namely, *caffeine*, could be extracted, in different proportions, from all of them.

It is even more curious to find that for centuries past a plant called coca, yielding a different principle, has been in use for a similar purpose, the effects of which, says Dr. Squibb, differ but little from caffeine, "simply producing a similar physiological effect in much smaller doses."

Comparing the power of these drugs in their tendency to counteract sleep, or promote wakefulness, the author found that three grains of caffeine were equal to three fluid drachms of the extract of coca, and to seventy minims of the fluid extract of camellia. These seventy minims of the latter extract equal seventy grains of tea, and this yields a little over two grains of caffeine. These are Dr. Squibb's figures.

Latterly, Dr. J. B. Andrews has reported on a long series of experiments with fluid extract of camellia and hydrobromate of hyoscine in the treatment of insane patients. With the first of these drugs he noticed a remarkable uniformity of action, the pulse being decreased from ten to twenty-four beats under the influence of various doses, while the force and tension were invariably increased. The full influence of the remedy was experienced in half an hour to one hour after administration. After remaining stationary for about half an hour, the pulse began to increase in frequency, and regained its normal condition in the course of another half hour, the effect of the drug disappearing in about three hours after taking it. It was used clinically in a number of cases, as a heart tonic, with favorable results.

New Use for Cold Air Machines.

Most persons have heard of the process for facilitating the drilling of artesian wells through strata of quicksand by freezing the quicksand with liquids brought to a very low temperature, and circulated through pipes introduced through the well tubing. *La Revue Industrielle* gives an account of an ingenious modification of this process, put in practice by a Swedish contractor for his own benefit, which deserves to be kept in mind for future occasions. The contractor had undertaken to drive a tunnel through a hill, on which stood a number of large houses. As the excavation went on, it was discovered that the surface of the hill was underlaid in many places with masses of gravel mixed with sand, and saturated with water, which ran out immediately into any excavation made in it. The escape of any considerable quantity of this material from under a building would infallibly ruin the building; and the foundation was so soft that the tunnel could not be lined with sufficient rapidity to prevent serious escapes. To underpin the houses from the level of the tunnel would have been a costly undertaking, and the contractor was obliged to have recourse to his wits for a solution of the problem. Fortunately, these did not fail him. It occurred to him that, if the wet gravel could be frozen, it might be worked as well as a hard material; and he considered whether it might not be possible to throw a stream of cold air upon it from one of the cooling machines now so often used. Inspired with this idea, he crossed the sea to England, and bought a Lightfoot ice machine, which he brought back with him and set up in the tunnel. The result surpassed his expectations. Before the cold blast the quicksand became a rock, which could be cut and worked easily and safely, and within a few weeks he passed under two five-story houses without experiencing any trouble.—*Amer. Architect.*

Fatal Effects of Alcohol.

According to Dr. Richardson, alcohol cuts down by disease, in England and Wales alone, 1,000 persons a week. What, adds the Doctor, if any other cause of mortality did the same? What if 1,000 persons per week died, in the same area, from the bite of the rabid dog or the snake, by the swallowing of arsenic, opium, or prussic acid? What if some thousand persons a week were known to be killed by the secret devices of the slow poisoner, who, under the guise of friendship, went about and instilled into his victims some subtle drop which led to the shortening of their life and to the production of lingering organic fatal disease? What, indeed, then would be the cry and the action? Why, all through the ranks of the great profession of medicine there would be a tumult of labor and toil, such as never before was seen, to remove the calamity. Men would be ambitious to be first to discover by experiment, by experience, the cause of so fearful an evil, and to remove it instantly; while he who won the victory over the calamity would be extolled as illustrious, and, crowned with honor, become a household word from among the children of Esculapius. Yet here one single cause making this deadly havoc, a cause well known and easily removable, in spite of its evils and in face of its easy removal, is permitted to remain in sight with a majority of the army of medicine looking on in apathy, pitying us "poor foolish fanatics" who are exercising our limited powers to uproot it, and some, with the rest of the world, so sharing the calamity as to become copartners in the destruction which follows from the participation.

Frozen Fishes.

On Nov. 18 a fishmonger of Paris, M. Heydendare, received from Gonda (the center of fisheries in the region about Rotterdam) a large consignment of fishes packed and preserved in ice. They could not have been caught later than the 16th, and were probably caught on the 15th. On unpacking, a jack was seen to move its gills slightly, and the idea occurred to wash it with fresh water, and immerse it in a vessel. In a few hours the fish was in its normal state, and very lively. M. Heydendare sent it to the Trocadero Aquarium, where it is to be seen now; it is a fine animal, about 2 ft. 4 in. long. Here, then, is a case of a fish out of water more than 48 hours (probably 3 days), packed with little care, along with dead fish and pieces of ice—traveling thus 280 miles, and coming to life again. The lowering of temperature was doubtless very favorable to maintenance of the vital functions.

© 1886 SCIENTIFIC AMERICAN, INC

PHOTOGRAPHIC NOTES.

Photographing by the Aid of Magnesium Light.—Mr. Goodwin, before the Glasgow and West of Scotland Amateur Photographic Association, recently explained a simple way of burning magnesium powder for taking photographs at night, which we find reported in the *Brit. Jour. of Photo.* A long camera stand is turned upside down, and the legs tied firmly together, a horizontal arm of wood about eight inches long is lashed as near the top as possible, and at the end of this is supported a small tin funnel, beneath which is a ring of cotton wick wet with alcohol. When in use, the stand is further raised by being placed on a bench or chair, and, everything being ready for the exposure, the wick is lighted, and the magnesium powder, mixed with two parts of fine sand, is poured into the funnel; a magnificent sheet of flame results, and the negatives obtained were very soft, the light having been thoroughly diffused. A thimbleful of magnesium powder with twice the amount of sand is sufficient for an exposure.

Photographing Colored Pictures.—Many experiments have been recently made in this branch of photography, more especially in Germany, which it is probable will shortly result in the formulation of a valuable process for accurately copying colored pictures, such as paintings, chromos, etc., in the true relation of the respective tints.

One class of experimenters believe that it is necessary to mix some dye like eosine or azaline with the emulsion, in order to secure the best results; others show that an ordinary commercial dry plate may be utilized by immersing in a bath of azaline. The film thus becoming impregnated with dye is as sensitive as if the latter was contained in the original emulsion. In either case it is suggested that a pale yellow screen of glass be affixed at the rear of the lens in the camera, when daylight is employed, in order to counteract the effect of the blue rays. Dr. H. W. Vogel, one of the early experimenters, says recently in the *Photographishe Correspondenz*, translated in the *British Jour. of Photography*, that he tried photographing on plates sensitized with azaline by lamplight, as follows:

I had two gas burners (Argand) at hand, which I placed right and left at a distance of about eight inches from one of my colored tables.

The direct light from the flame was screened from the lens by sheets of tin.

The lenses were of the stereoscopic class, with four inches back focus, without stops.

The first experiment showed at once that azaline plates with this illumination had a sensitiveness far beyond what I had expected.

Two minutes' exposure proved to be much too long.

I reduced the exposure to one and a half minutes, and finally to fifteen seconds; even with this short exposure the plates appeared to be overexposed, and the negatives were so vigorous that they took a long time to print.

An exact comparison with daylight showed that through a dark yellow glass screen at one o'clock in the afternoon of Dec. 7, in clear weather, six seconds was necessary to give a well exposed picture of the color table; so that in fact it is possible to obtain by lamplight, *without a yellow screen*, an image with true color relation, with an exposure only two and a half times as great as that with daylight and a yellow screen.

The photograph by lamplight had almost exactly the same relation to the colors as that by daylight. For photographing colored bodies by artificial light a new way is thus, by means of azaline plates, opened.

Further, the interesting fact is established by these experiments, that an azaline plate is more sensitive by lamplight than an ordinary dry plate with the same emulsion.

Quicksilver Production and Trade, 1885.

Mr. J. B. Randol, of San Francisco, gives the following information:

California is the only State in America where cinnabar is mined in paying quantities, and where the production of quicksilver from that ore is worthy of notice.

The year 1885, like the three years preceding, has been unsatisfactory in production and price.

In 1881, when 60,851 flasks of 76½ pounds each were produced, the price ranged from $27.90 to $30.75 a flask; in 1884, 31,913 flasks produced sold for from $26 to $35; and last year the product, 32,073 flasks, realized $28.50 to $32. With this large decrease in production—nearly one-half since 1881—there has been no corresponding rise in price, which, united, have caused the quicksilver industry to be almost entirely unprofitable; for, with deeper mining, the expenses have largely increased, and the ores have also become scarcer and poorer.

In this condition of affairs, all the mines would be compelled to cease operations were it not for the *ad valorem* duty of 10 per cent placed on the quicksilver produced by cheap labor at the rich mines of Almaden, Spain, and Idria, Austria, owned and worked by the governments of those countries.

It is not known that any of the ten quicksilver mines worked in California earned a dividend last year; but it is quite certain that none was paid, and the prospects for the future in that direction are quite unfavorable. To make this industry fairly remunerative, it is necessary for the government to foster it by a duty of not less than ten cents a pound, and even that would leave the strength for survival one of great uncertainty and difficulty.

The total production for 1885 was 32,073 flasks. The New Almaden mine is credited with 21,400, or 1,400 flasks more than it made in 1884; all the other mines, ten in number, had an aggregate of 10,673 flasks, which was 1,240 flasks less than they together produced in 1884.

The Gaudalupe mine made only 35 flasks, then entirely ceased operations, and is supposed to be permanently closed. The Sulphur Bank mine made a last dying effort to continue a producer; but it is believed its superficial deposits will soon be exhausted, and then one more will be added to the list of closed mines, in which category may also soon be included the Redington, Great Eastern, Ætna, New Idria.

The exports by sea from San Francisco were 15,730 flasks, an increase of 829 over the previous year. Ten thousand flasks were sent out of the State by railroad to Arizona, Utah, Idaho, Montana, and Mexico, and it is estimated that about 10,000 flasks were consumed in California and Nevada, leaving the San Francisco market bare of stock at the end of the year.

The low price of silver has shut out quicksilver as an article of export to China, and it has also seriously cut down the profits on shipments to Mexico.

Perhaps the exhaustion of the American quicksilver mines, quite sure to come before the year 1900, may yet have an important bearing on the oversupply of silver now agitating the financial and political world; for with the sources of quicksilver controlled, as they then would be, solely by the governments of Spain and Austria, it would be in their power to limit the production, and to greatly increase the price, even to a point above where it would be a loss for the silver mines to mine any but the richest ores. Thus the output of silver could be diminished from all mines except the few having smelting ores.

A Peculiar Illumination.

A brilliant phenomenon has been noticed at Beaver Falls and other places in Western Pennsylvania, where natural gas blow-off pipes send out their large volumes of flame into the frosty night air, which has aroused particular interest both from its beauty and the absence of any fully satisfactory explanation.

At those works which receive their supply of natural gas directly from a well, and are running only during the daytime, the gas is permitted to escape into the atmosphere at night, and to avoid the roaring sound is usually ignited as it issues from the top of the blow-off. These gigantic torches light up the country for miles around, the effect being particularly noticeable in cloudy weather, when the glare is reflected. It has been observed that in certain conditions of the atmosphere a vertical, feathery, and very brilliant arrow of fire extends above the flame almost to the zenith. Its greatest brilliance is perhaps at its highest point, where it is described as being quite as bright as a rod of iron at a white heat. The natural pulsations of the gas, as it rushes from the blow-off, affect the outpouring flame, and give the luminous arrow a leaping, flashing motion which adds greatly to its beauty. The observers agree in stating—and the fact is significant—that the conditions necessary for the appearance of the phenomenon depend upon the presence of a frosty atmosphere and an appreciable haziness, or else it is visible either during or immediately preceding a light, fleecy fall of snow, the temperature being somewhat below the freezing point.

Bearing these facts in mind, it is not difficult to explain the arrow. The minute crystalline faces of the suspended snow or ice particles catch the light from the burning torch, and reflect the rays in precisely the same manner as the ocean, or other expanse of water, on a moonlight night, gives us a long, silvery path of reflected moonbeams. This explanation finds further confirmation in the fact that the arrow extends only to the upper limits of the haze, and when the lower atmosphere is clear, begins at some distance above the flame.

Accident to the Pont Neuf.

On the morning of December 17, about six o'clock, a serious accident was found to have occurred at the Pont Neuf, the oldest and best known of the Paris bridges. On that part of the structure crossing the narrower of the streams into which the Seine is divided by the island of the Cité, the third pier had sunk, and the pressure of the arches toward the subsidence had torn up the pavement of the footpaths and the causeway. An alarm was given by persons who were crossing the bridge, and traffic was at once stopped by the police. A large crowd soon collected, and could see the outer stones of the bridge break off in large masses and fall into the river. Barriers were erected at both ends of the bridge, and the gas pipes crossing it were cut off and rendered secure.

It was found that the part of the bridge which had been injured had subsided 65 centimeters. That part of the bridge which crossed the wide stream is secure, but the other part will have to be entirely rebuilt. The city engineers state that the work will be long and tedious, and that while it is going on it will be necessary to erect a temporary bridge connecting the Quai des Orfevres and the Quai des Grands Augustins. The common proverb, "Solide comme le Pont Neuf," has thus been falsified.—*London Times.*

How a Wise Man Built His House.

Many of our readers will find their own experience reflected in the following paragraph taken from the last number of the *Central Law Journal*, where it is used to illustrate another subject. A gentleman wished to build for himself a nice mansion, and, of course, was exceedingly anxious to have the approbation of his friends and neighbors. So he asked the advice of all. The first said, "Here is a nice site, and I should build such a style of house." The second said, "I don't like that site nor the style of house." The third came along, and was utterly amazed at the selection of the site made by the others, and of their total want of taste in architecture. He said, "Leave off all that; here is the most charming spot for a house, and here is the most exquisite plan for a house." And so it went on until the gentleman became disgusted with his advisers, and went and selected his own site and adopted his own style of architecture, and builded a house to suit himself. By a multitude of counselors there is wisdom, but the house builder's experience in seeking the advice of his neighbors found it different, and was probably wise in rejecting all their suggestions, and following the plans his own judgment dictated. The moral here conveyed does not end with locating of a house site or the erection of the building. It will be generally found best to follow one's own impressions and taste rather than to defer to others.

The Universal Telemeter.

Some interesting experiments were recently carried out on the Thames Embankment with the universal telemeter, a new surveying instrument, the invention of the Abbe Luigi Cerebotani, Professor of Astronomy and Mathematics at the University of Verona. The instrument consists mainly of two glasses capable of accurate adjustment, the one acting as the base line, the other, the side of an angle. The direction of the glasses is gauged by a graded rule, by means of which the distance between the two glasses of observation and the point to be measured is registered, rendering the finding of the required length of line a matter of easy calculation. The stand on which the telemeter is fixed is provided with a drawing board, on which the objects measured can be dotted as the measurements are obtained, thus gradually forming a plan of the country surveyed. The whole is exceedingly simple, and can be worked by any one not posssessing special knowledge. The telemeter has already been tested by Herr Foerster, of the Berlin Observatory, and one is now in use by the German War Office. The instrument seems well adapted to ordinary surveying, although it might possibly be urged that its utility may be somewhat handicapped by the shortness of its base line.

The Cost of Wheat Production.

The phenomenally low prices for wheat which have prevailed during the past year have directed attention to the details of the cost of producing that grain, and in various States of the wheat section the statistical experts are making calculations to settle the question whether, at the prevailing prices, the culture of wheat can be profitably continued. One of the most interesting reports yet published on this point has been made by the Michigan Secretary of State concerning the cost of producing and marketing the wheat, oats, and corn crops of 1885 in that State.

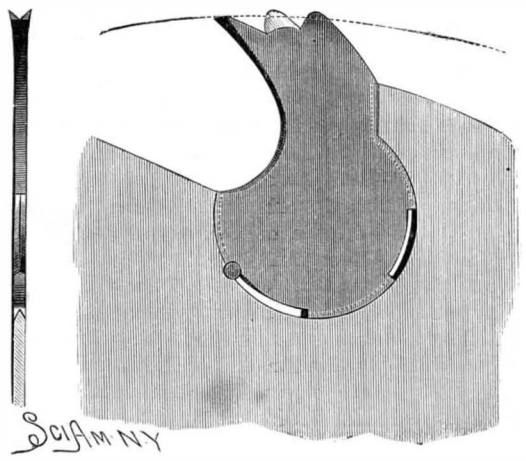
The average yield per acre is given at 21·98 bushels of wheat, 40·55 bushels of oats, and 70·87 bushels of ears of corn. The yield thus indicated applied to the cost per acre shows an average cost per bushel of 59·1 cents for wheat, 29 cents for oats, and 21·1 cents for ear corn. The average price of wheat on January 1, for the State, is placed at about 74 cents, oats 30 cents, and corn 24 cents per bushel of ears. In regard to wheat, the report observes that the "net profit on investment in the southern counties is 38 per cent, and in the northern counties 35 per cent."

P. ORR & SONS, of Madras, write that, owing to the terrific rains in India, a good waterproof roofing is very necessary. The writers think the paper tile referred to in the SCIENTIFIC AMERICAN of Oct. 31 might be specially adapted to their climate and storms, and suggest that the manufacturers of the article send them samples for trial.

© 1886 SCIENTIFIC AMERICAN, INC

SAW TOOTH.

The saw plate is of the usual description. The removable tooth consists of a circular plate in which is formed a notch, at one side of which projects a cutter having a saw tooth point and the smooth cutting knife edges, which are formed on opposite sides of the cutter (as shown in the end view of the tooth and plate), and are bent outward slightly away from each other to bring them into engagement with the wood. These knives project outward beyond the cutting point, so that they will cut deeper into the wood than the point; the point of every tooth removes the material cut by the knives on the tooth in front of it. This construction insures a clean cut, without making any dust. The periphery of the circular part of the tooth and the back of the cutter



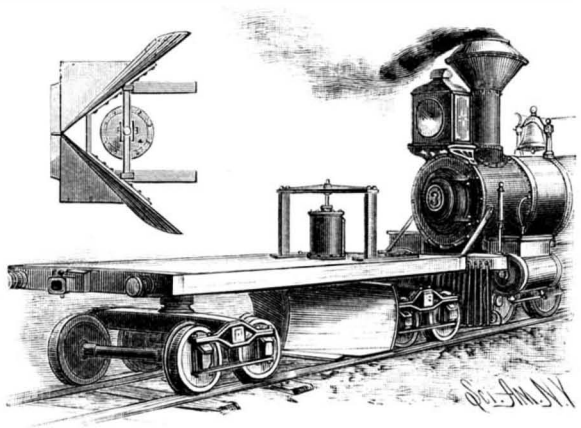
WILSON'S SAW TOOTH.

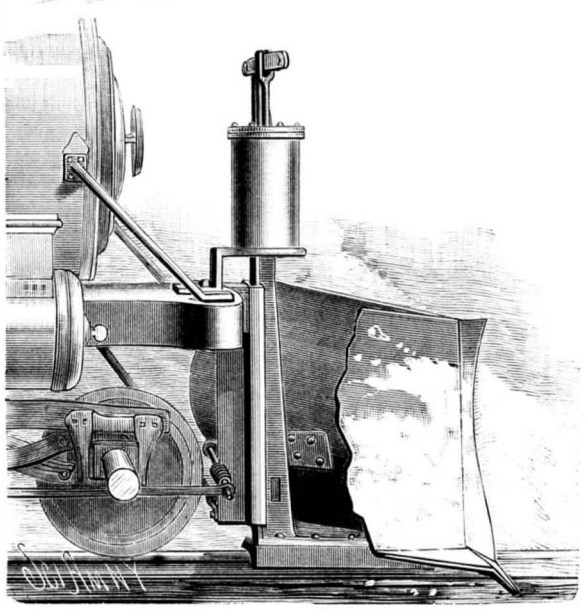
are provided with a V-shaped groove, which is adapted to receive a V-shaped tongue formed on the edge of the circular part of the blade; and portions of the edge of the tooth and of the plate are cut away to admit of placing the tooth in the circular notch before bringing the tongue and groove into engagement with each other. The tooth is held firmly in place by a rivet or screw, part of which enters both the tooth and plate. It will be seen that the tooth can be removed from the plate by turning it through a part only of a revolution. The backward movement of the cutter is limited by the shoulder formed on the plate and against which it rests.

This invention has been patented by Mr. C. J. Wilson, of 114 Clinch Street, Knoxville, Tenn.

IMPROVED SNOW PLOW.

The accompanying engravings represent a snow plow that can be attached either to the front of a locomotive or to the middle of a platform car. The body





ORMEROD & CROSKEY'S SNOW PLOW.

of the plow is composed mainly of a base portion and wings that meet at the center to form the front flange and is attached to the locomotive in such a manner that it may have both a vertical and lateral movement independent of the locomotive, so that it will follow the track at curves and may be lifted from the track, and will not interfere with the sway or lurch of the engine. The raising and lowering of the plow may be done by lever or steam power, but it is preferred to employ compressed air, and for this purpose a cylinder is attached to the frame of the plow, the piston being so connected that, when it is operated by admission of compressed air to or its exhaust from the cylinder, the plow will be raised and lowered accordingly.

The construction is such that in rounding curves the locomotive will throw the plow into the center of the track. The upper surface of the base portion of the plow is extended to form a lip, which is cut away to span the rails, so that the plow may be lowered to remove the snow from the center and sides of the track, somewhat below the upper surfaces of the rails. The snow and ice are removed from the surfaces of the rails themselves by sharp edges running in contact with them when the plow is lowered for work. For properly guiding the plow body along the track, wear plates and flanges that run in contact with the rails are secured to the lower plate of the base.

When considered desirable, the plow can be mounted in the center of a short car, as shown, in which case the combination uniting the plow and truck can be dispensed with. The body of the plow is attached to vertically movable plates, and is raised and lowered by a piston in a cylinder placed on top of the platform of the car.

The inventors of this plow, Messrs. Thomas Ormerod and A. B. Croskey, of Leadville, Colorado, claim that by raising and lowering the body of the plow vertically in slides it does not clog up with snow or ice, thus being preferable to plows or flanges that are raised on hinges.

HANDLE FOR CANS.

The handle for fruit, meat, and paint cans here shown is folded closely against the side when the can is stored, but can be readily arranged as a handle

COLEMAN'S HANDLE FOR CANS.

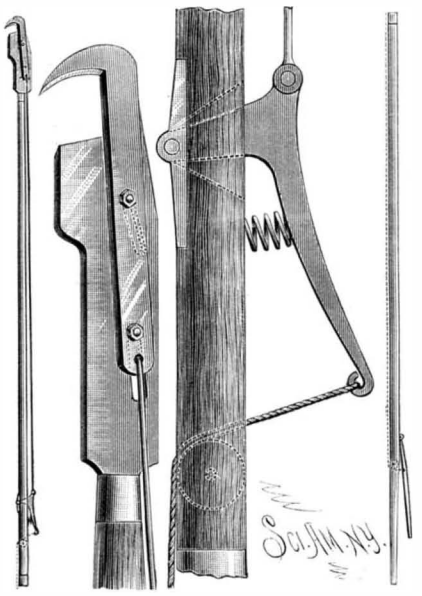
when the contents of the can are to be removed. The rectangular frame of wire is curved to conform to the shape of the can, to which it is soldered at the middle of its ends, so that it will remain in contact with the can, and occupy very little room; when necessary, the wires can be bent outward to form the handle, as shown in the right hand view. To give the handle additional strength at the point of its attachment to the can, the iron can be bent inward at the middle of the upper and lower sides of the frame, as shown in the lower part of the engraving. After serving as a package, the can can be converted into a convenient household article.

This invention has been patented by F. W. Coleman, M.D., of Rodney, Miss.

AUTOMATIC WATER WORKS.

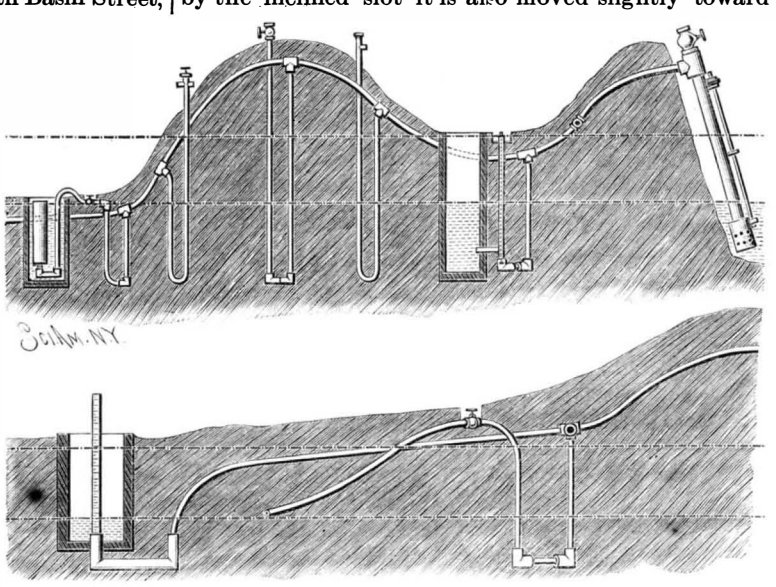
The object of this invention, which has been patented by Mr. M. A. Laska, of 148 North Basin Street, New Orleans, La., is to provide water works for automatically delivering water without the use of a motor or other power machinery. One end of the siphon pipe is dipped into the water in the river or bay to a point below the low-water mark, and the lower end of the pipe is passed into a cylindrical cup having a closed bottom on which a packing piece rests. This cup is formed with numerous apertures and with lugs through which passes a rod also passing through guide lugs on the pipe. The upper end of the rod is screw-threaded and passed through a nut held to the pipe. This cup serves as a strainer, and can also be used to close the end of the pipe when the apparatus is to be put out of operation. On the upper end of the pipe is a casing to which the main water-conducting pipe is connected. On the casing is a cock, and above it is a neck for attaching a hose.

The main pipe is conducted underground in the desired direction, and to it are connected numerous branch pipes which conduct the water into tanks or cisterns. The bottom of each cistern is below low-water mark, and the delivery pipe enters the cistern below the low-water mark, or, if it enters at the top, it must extend below the low-water line, as shown to the left in the upper engraving. When the pipe is carried over an elevation, it is extended below the low-water line at both ends of the bend, and a pipe extends from the highest point of the bend down below the water line, and then returns to the surface of the ground, where it is provided with a cock. The inner end of the main pipe is connected with a



BROWN'S ACME THORN CLIPPER.

glass gauge-tube in a cistern. At the wells is a pipe extending to the surface of the ground and connected at its lower end with the delivering pipe. Extending through the vertical pipe is a rod carrying a valve at its lower end and a hand wheel at its upper end; this valve shuts off the supply to the well. When the pipe enters the top of the cistern, the outlet is provided with a float operating a valve, so that if the level of the water in the river should rise to such a height as to flood the country, the float would rise and close the valve, thereby shutting off the water. The pipes are first filled with water through a hose connected with the neck of the casing at the inlet. This starts the siphon, and the water runs into all the cisterns until the level is equal to that in the river.



LASKA'S AUTOMATIC WATER WORKS.

PRUNING IMPLEMENT.

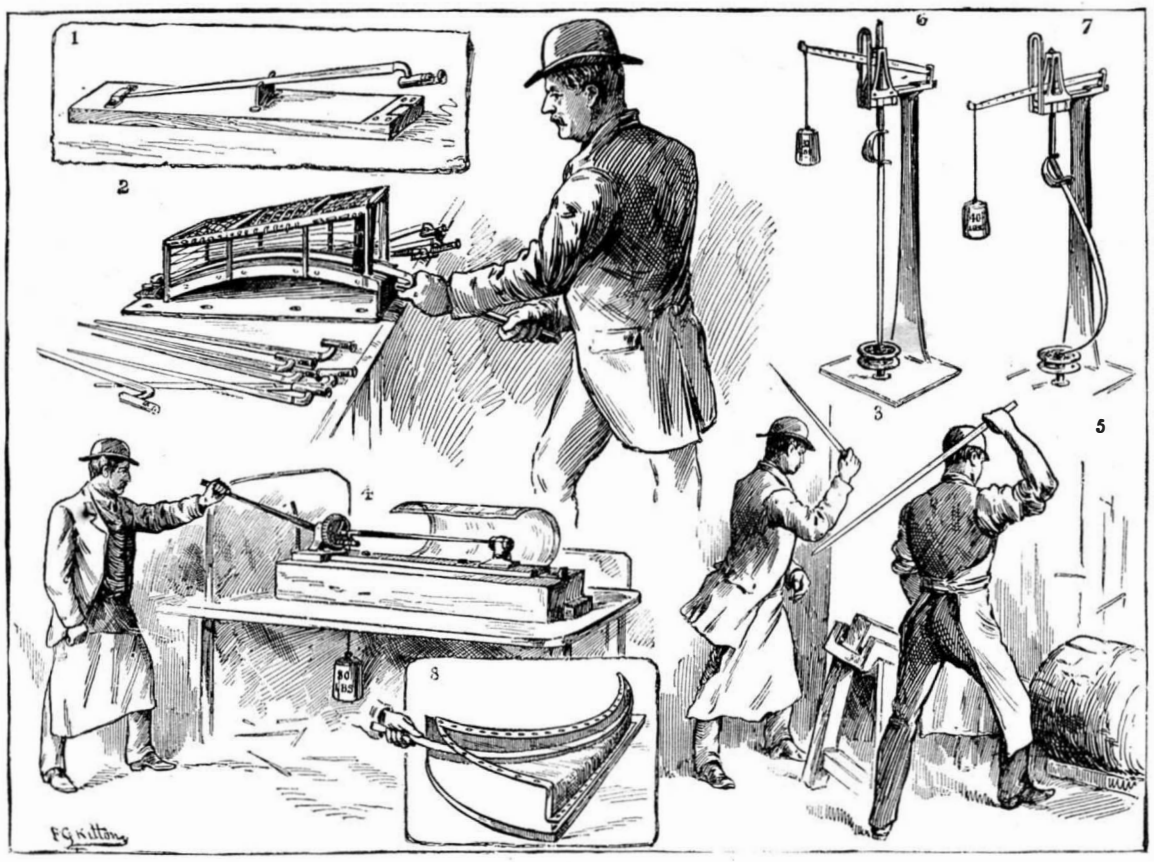
The chisel secured to the upper end of the pole is formed with a lower longitudinal slot and with an upper inclined one. A hook having a cutting edge at the bottom of its prong is arranged to slide on the side of the chisel, and is guided by screw bolts passed through the slots. Connected with the lower end of the hook is a rod whose lower end is connected with an angle lever, the shank of which is passed through a slot in the pole and pivoted to a clip. To the other end of the lever is attached a cord passing over a pulley in the pole, as shown. On the lower end of the rod is a ferrule to receive the upper end of an extension rod, near the lower end of which is a pulley over which the lower part of the cord passes, the end of the cord being secured to a lever pivoted on the extension rod, as shown in the right hand view. The cutting edge of the chisel being placed against the branch to be cut, the lower lever is swung from the rod, thereby moving, by means of the cord, the lower part of the upper lever toward the rod. The hooks are thus pulled downward, but as it is guided by the inclined slot it is also moved slightly toward the edge of the chisel, and a shearing cut is made. When the lower lever is released, a spring under the upper one presses the lower part outward and raises the hook. This invention has been patented by Mr. William H. Brown, of Dunedin, Fla.

© 1886 SCIENTIFIC AMERICAN, INC

TESTING BAYONETS AND CAVALRY SWORDS.

Previous to the year 1885, the long triangular Martini-Henry bayonet was tested by being sprung over a bridge two inches high, as depicted in our sketch (No. 1). The point of the bayonet was held in a shoe, the center of the blade rested on the bridge; the socket was then pressed down till it was level with the point. The bayonet had to stand this test without receiving a permanent "set." This test was considered sufficient till the campaign in the Soudan showed the necessity for a more severe test. The bayonet now, instead of being sprung over a bridge, is bent down over a curved block of wood (Fig. 2), on all three sides, which tests every part of the blade from point to shoulder; if it stands this without receiving a "set," it is then struck two or three times on each face on a solid wood block (Fig. 3); this is with the object of testing the temper and quality of metal, and for detecting flaws. If the bayonet stands this test, it is finally subjected to the twisting test (Fig. 4). In this the socket is placed in a revolving disk with a weight of 80 pounds attached to it, the point being held stationary; the bayonet is twisted through an arc of a quarter of a circle, and on being released must recover its figure.

Cavalry Sword, Pattern 1885.—The tests for this sword are also extremely severe (Fig. 5). The blade is first struck on back and edge on a solid oak block to detect flaws. The rigidity of the blade is then tested by placing it in a machine (Fig. 6), and bringing a weight pressure on it of 32 pounds; it must support this weight without deviating from the straight line. Its elasticity is next tested in the same machine (Fig. 7). A weight pressure of 40 pounds is applied, depressing the hilt six inches, as shown in the sketch. On the weight being released, the blade has to recover itself; the blade is then finally tested round a curved block of wood (Fig. 8), on both sides. After all these tests the blade should remain absolutely straight, without having received a permanent set. If it is set in the smallest degree, it is cast out. From the above brief description, it will be seen that it is almost, if not quite, impossible for either a cavalry sword or a triagular bayonet which is either too soft or too hard to be passed into the service.—*London Graphic.*



1. The "Bridge" Test (old style) for Triangular Bayonets.
2. The "Curve" Test (the method adopted during the past two years).
3. The "Striking" Test for Bayonets.
4. The "Twisting" Test for Bayonets.
5. The "Striking" Test for Cavalry Sword Blades.
6. The "Vertical Pressure" Test for Cavalry Swords. (A weight of 32 lb. must not deflect the blade.)
7. The "Vertical Pressure" Test. (A weight of 40 lb. must shorten the blade by six inches without breaking it.)
8. The "Curve" Test for Sword Blades.

TESTING BAYONETS AND CAVALRY SWORDS AT THE ROYAL SMALL ARMS FACTORY ENFIELD.

SCREW CUTTING AND SELF-ACTING SLIDING GAP LATHE.

We give an illustration from *Engineering* of a screw cutting and self-acting sliding gap lathe, constructed by Messrs. John Lang & Sons, Johnstone, Eng. The fast headstock is 6 ft. long and is in one casting to the ground line, where it is securely bolted to the gap frame. The head is 6 ft. 6 in. wide at the base, and is carefully designed to resist the various strains to which it is subject. The spindle is of steel and has a front journal 10 in. in diameter by 15 in. long.

The cones on the spindle and counter gear are turned inside as well as outside, so as to be properly balanced. The largest step of the cone is 3 ft. 6 in. in diameter, and the smallest step is 22 in. in diameter. The face plate is 9 ft. in diameter, with an internal wheel cast on the back. The gap frame is of massive proportions, and is arranged to swing 15 ft. in diameter and 4 ft. clear of the face plate in front. The bed is 20 ft. long, 4 ft. broad, and 20 in. deep, and is arranged to slide from 12 in. to 6½ ft. from face plate. The leading screw is of steel, and is 4½ in. in diameter; it is accurately cut to Whitworth standard thread. The motion for driving the leading screw for general work up to 10. ft. diameter is communicated through the shaft crossing the gap frame; but when the work is over 10 ft. in diameter, the motion is carried around the end of the gap frame by shafts with bevel gearing, the shaft crossing the gap being then withdrawn.

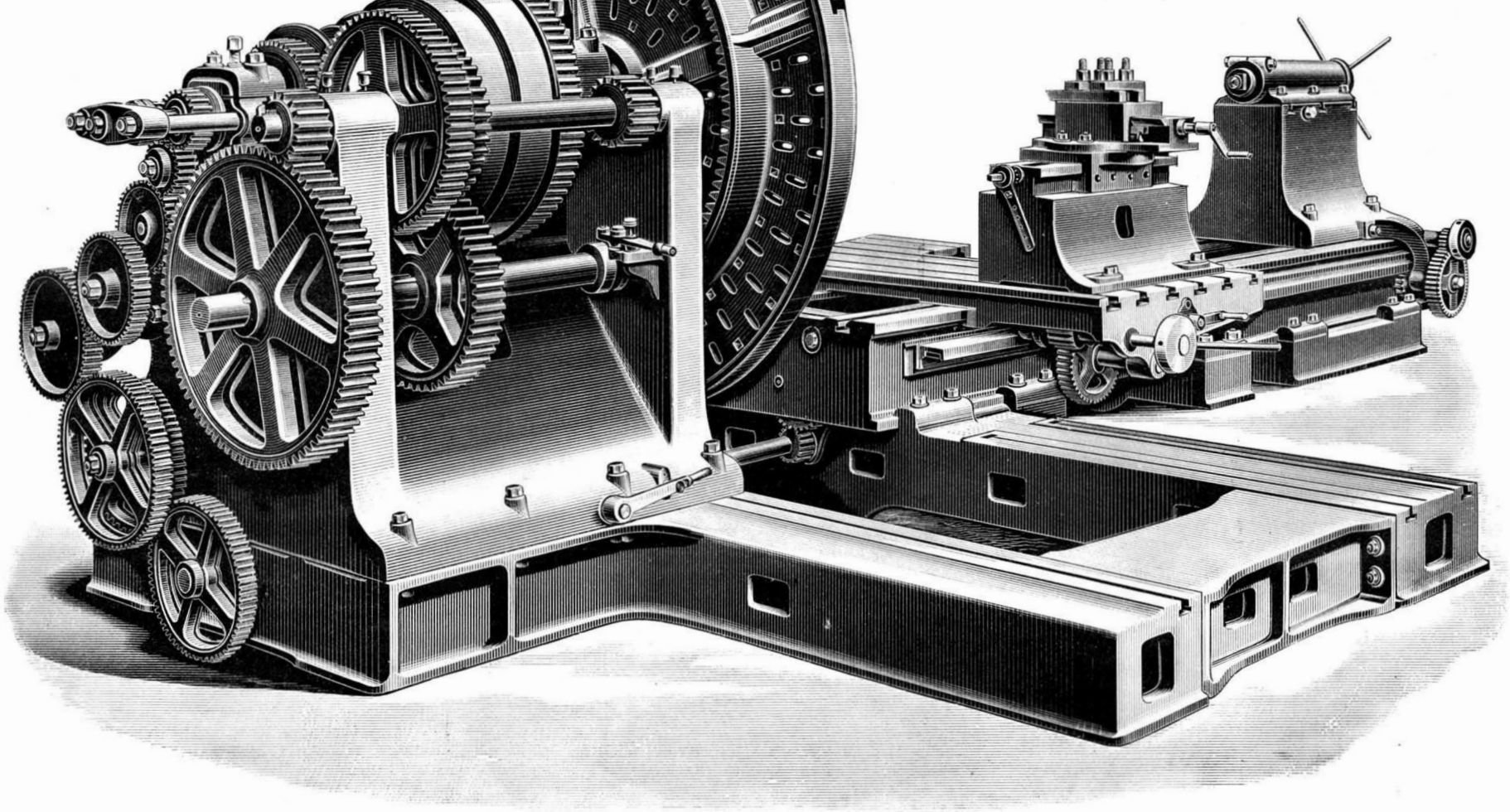
The shifting headstock is fixed in alignment with the running head by sliding in T-slots planed out of the bed, and having V-lips in which the headstock is fitted. Four bolts from these T-slots secure the headstock in position when turning.

All the gearing of the lathe is carefully designed and of ample strength for heavy duty; the arms wheels are all of the box pattern, and all teeth of the wheels, including the change gears, are machine cut from solid lanks, so as to give smoothness and steadiness of cut, with little or no backlash, and the nearest possible approach to noiselessness of action.

The internal wheel on the back of the face plate, and the bevel feed motion, are cast from machine cut patterns, having a correct form of tooth. The gearing is proportioned so as to give an equal percentage of variation at each change of speed. A strong stool is supplied to cross the gap frame and carry the slide rest for use when turning large diameters.

This lathe, which weighs complete 45 tons, was constructed for the Glenfield Company, Kilmarnock.

THE cost of smallpox to Tennessee during the past five years is estimated by the State Board of Health to be $141,619.91.



IMPROVED SCREW CUTTING AND AUTOMATIC SLIDING GAP LATHE.

© 1886 SCIENTIFIC AMERICAN, INC

Longevity of Butterflies.

A correspondent of the *Times*, referring to Sir John Lubbock's discovery of much greater longevity of ants than has hitherto been believed, thinks that the same may be true with regard to the butterfly, although the common notion is that the butterfly's life is a short and merry one. The correspondent, who writes from Bournemouth, then relates the following incident:

"On August 15 last a fine peacock butterfly flew into our house through the garden door, and was caught and put under a large bell glass. On the following day another came in, and was also put under the glass. They were supplied daily with fresh flowers and a few drops of new honey, which they evidently much enjoyed. No. 1 died during a suddenly cold night; No. 2 lived until yesterday, December 14. Whenever the sun shone upon their cage, which was placed on a table near a large window of plate glass, they opened their beautiful wings and flew about vigorously, occasionally resting on a flower to thrust their trunks deeply into its corolla, or standing over and sucking up the drops of honey. The extraordinarily sensitive nervous system of these little beauties was indicated by the most rapid vibratile trembling of the wings directly the sunlight or the scent of fresh flowers reached them. When the sun was not out, they usually remained perfectly still, with their wings closed, especially selecting to hang on the under side of a leaf. They showed great intelligence in distinguishing the freshly gathered flowers and in deciding that honey was the right thing to eat, and I have seen one of them scramble with considerable difficulty across his cage through a tangle of leaves and stalks, determined to get to a particular leaf on which he wished to hang. After some unsuccessful attempts to reach it, he hooked it down with one foot, then held it with another, until he could get the rest of his legs upon it, having done which he appeared satisfied, shut up his wings, and hung himself upon it, topsy-turvy, to rest. If he failed to do what he wished with one leg, he immediately tried another, appearing to think that, having six at his disposal, it was foolish to waste much time on any one. But he only used his most anterior pair on very special occasions. How long each butterfly had lived before it was caught I do not know, but No. 2 lived in its glass cage 121 days."

Influence of Hot Drinks on Digestion.

Various opinions are held by the public, and we believe by medical men also, on the effect of hot drinks on the digestion of food. This matter has lately been investigated by Dr. V. E. Nyeshel, of St. Petersburg. The plan he adopted was to make use of twenty patients in the surgical wards of the Obukhoff Hospital, suffering from fracture of the fibula, contusion of the foot, and such like affections, and dividing them into two sets of ten each, to find out first, by a three days' experiment, the length of time an ordinary meal of soup, meat, potatoes, and black bread required for digestion. For this purpose the stomach tube was employed at periods varying from five to seven hours and a half after the meal, and the condition of the contents of the stomach examined. In all the cases complete breaking down appeared to have taken place in about six hours and a half. The exact time required by each individual for the digestion of the specified meal being noted, further observations were made on a subsequent day, the patients in the first group being given after the meal hot tea, at a temperature of from 40° to 75° C., the quantity taken varying from two to eight tumblerfuls. The contents of the stomach were drawn off at the time when, as former experiments had shown, digestion would, under ordinary conditions, have been complete. The result was that, when not more than three tumblerfuls of hot tea had been swallowed, it was found that digestion had progressed just as well as without it, but a larger quantity of hot tea appeared distinctly to retard the digestive process. The second group of patients were given a meal similar to what they had had before, but hot. On examining the contents of their stomachs, no difference could be detected between the rate of digestion of hot and cold food. The author found that by painting the pharynx with a 5 per cent solution of hydrochlorate of cocaine the tube passed easily and quickly.—*Lancet.*

Extracting Teeth with the Pistol.

Old Dr. Monsey extracted teeth by fastening a strong piece of catgut securely to the tooth, to the opposite end of which he affixed a bullet. With this bullet and a full measure of powder, a pistol was charged, and when the trigger was pulled, the operation was performed effectually and speedily. Once a gentleman who had agreed to try the novelty, and had even allowed the apparatus to be adjusted, at the last moment exclaimed, "Stop, stop, I've changed my mind!" "But I haven't, and you're a fool and a coward for your pains," answered the Doctor, pulling the trigger. In another instant the tooth was extracted, much to the timid patient's delight and astonishment.

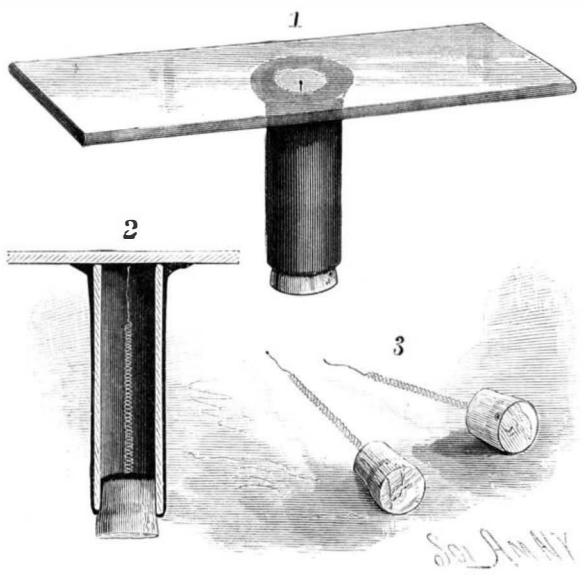
MICROSCOPIC OBSERVATION OF VIBRATING RODS.

BY GEO. M. HOPKINS.

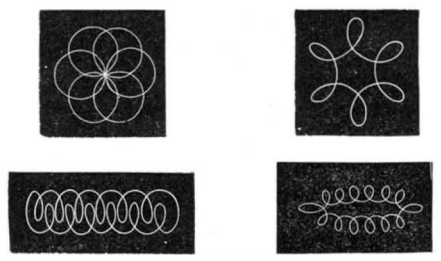
A metal rod fixed in a vise at one end, with a silvered glass bead attached to the other end, constitutes Sir Charles Wheatstone's apparatus for the study of the transverse vibrations of rods.

By vibrating a rod arranged in this way Wheatstone was enabled to obtain an almost infinite variety of symmetrical and beautiful luminous scrolls.

It is a simple matter to repeat Wheatstone's experiment with the apparatus alluded to, but it is not always convenient to do it.



VIBRATING ROD MOUNTED FOR MICROSCOPIC OBSERVATION.



CURVES TRACED BY VIBRATING ROD.

A vibrating rod permanently mounted in a cell and arranged for observation with a microscope is shown in the annexed engraving; Fig. 1 representing the mount in perspective, Fig. 2 showing it in section, Fig. 3 showing the rods detached from the mount.

To an ordinary 3 × 1 in. glass slip is connected a paper tube $\frac{5}{16}$ in. internal diameter and 1¼ in. long, well blackened on the inside.

The cement is applied carefully, so as to have the glass clean and clear within the tube. To a cork fitted to the open end of the tube is cemented a wire spiral formed of about 4 in. of No. 40 spring brass wire. The diameter of the spiral is $\frac{3}{32}$ in. The end of the spiral next the glass slip terminates in a straight arm ¼ in. long, upon the end of which there is a minute bead of black glass. A smooth bead is secured by first fusing borax on the end of the wire, then touching the borax while in a fused state with a thin thread of black glass, then breaking the thread a short distance from the end of the wire, and finally fusing it by gradually pushing it forward into the flame until a perfect bead of the required size is formed.

The cork with the spiral is inserted in the paper tube with the bead arranged centrally with reference to the tube, and only a very short distance below the glass.

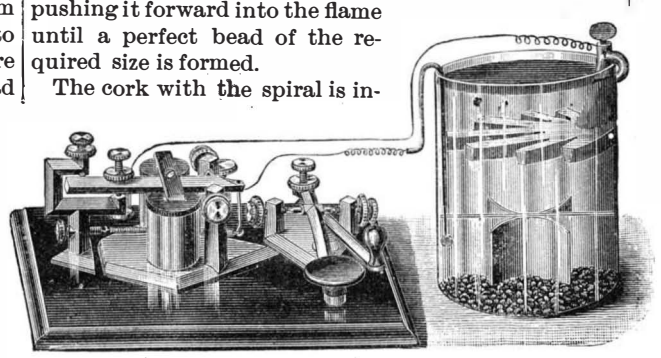
By placing the mount thus prepared under a 1 in. or 2 in. objective, and allowing light to fall on the bead from one direction, it will be noticed that the black glass bead is rarely at rest, the bright pencil of light reflected from it continually describing curves of various forms. Stepping on the floor of the room in which the microscope is located is generally sufficient to set the spiral into active vibration.

Rapping on the table on which the microscope rests will cause the bead to describe intricate curves.

By striking the side of the paper tube with more or less force, different figures will be produced.

Illuminating the bead from two points produces parallel curves.

While this mount is perhaps not strictly a microscopic object, it may nevertheless be viewed to advantage by the microscope.



THE DIAMOND LEARNER'S TELEGRAPH INSTRUMENT.

The Electric Light in the British Navy.

A trial has just been made at Portsmouth of an installation of the electric light which has been fitted on board the Imperieuse by Messrs. Siemens Brothers & Company, who are also about to provide similar installations on board the Warspite, Edinburgh, Collingwood, and Rodney. The lights on board the Imperieuse comprise 375 incandescent lamps of 20 candle power, which are disposed so as to illuminate all parts of the ship, including the engine rooms, stokeholes, and magazines; and also a couple of search arc lights, placed at the bows and at the stern, and which are each equal to the power of 25,000 candles. The currents are generated by three Siemens dynamos, on the combined and self-regulating principle, each of which is driven by one of Willen's compound two-cylinder engines, which is fixed to the same bed plate as the machine which it drives. The number of revolutions per minute is 400. The machines are interchangeable, and can be connected or thrown out of action by a simple switch arrangement. One of the machines supplies the search lights, and another is equal to maintaining 320 of the incandescent lamps aglow, which is considered as many as will be necessary as a rule to be alight at the same time. When the whole of the incandescent lamps are required to be lighted at the same time, two dynamos will be demanded for the several leads, otherwise one will be kept as a reserve against accidents. The arrangements have been superintended on behalf of the company, says the *Naval and Military Gazette*, by Mr. Collings, and the preliminary trial during the day and after dark proved very satisfactory.

Shying Horses.

This trick or vice is generally the effect of nervous timidity, resulting from an excitable temperament. It is aggravated by improper handling. To punish a horse for shying introduces a new cause of fear. The horse will be more alarmed and show more tokens of fear at the prospect of a whipping than at the imaginary object of danger in the road. Hence one bad habit is confirmed by the introduction of another. It is impossible to whip terror out of a horse or pound courage into one. Kindness and gentle persuasion are the best weapons to correct the pernicious habit of shying. The less fear exhibited by the driver, and the less notice taken of the shying by using harsh means, the sooner it will be given up. A careful, experienced horseman can generally detect an object likely to cause a nervous horse to shy, and by word or touch will encourage him to pass it unnoticed. When this fails, give him time to look at the object of his fear; pat him and coax him up to it, then take him past it two or three times, till he takes no notice of it.

When defective sight is the cause of this bad habit it is incurable, and if the eyesight is failing, the horse for ordinary driving and riding will be perfectly useless. A mare we knew that had gone quietly in harness for two or three years, suddenly took to jumping the white stone crossings of an ordinary macadamized street, as if they were water brooks. In three months she was stone blind.

THE DIAMOND LEARNER'S TELEGRAPH INSTRUMENT.

The leading feature of the instrument here shown consists in so forming the sounder, anvil, and key that they have a diamond-shaped cross section, and in so making the base of the sounder and of the anvil that when set up the two form a diamond outline. The magnets of the sounder are inclosed in metallic cases, and the various metallic portions of the instrument can be made to present the appearance of either gold, bronze, or brass. The black baseboard is of wood.

This instrument—designed by the Novelty Electric Company, of 5th and Locust Streets, Philadelphia, Pa.—presents a unique and attractive appearance.

Toads as Bee Eaters.

The toad may be useful in kitchen gardens as a slug and insect destroyer; the freer you can keep your apiary from his presence, the better. Toads will wait at the foot of a hive to seize any honey-laden bee that may happen to fall to the ground on its return from foraging, and one bee master, says a correspondent of the London *Graphic*, saw over a dozen little workers captured in the space of half an hour by an old fat fellow, who darted out his tongue with wonderful celerity immediately he saw a bee on the ground. The bees had been collecting pollen, and many of them, being heavily laden, were unable to reach the floor board of the hive.

A Guide to Rose Culture.

Beautiful Roses for All.—We have received the *New Guide to Rose Culture*, published by the *Dingee & Conard Co., Rose Growers, West Grove, Pa.* (see advertisement), and take pleasure in recommending it as one of the handsomest and best catalogues of the season.

© 1886 SCIENTIFIC AMERICAN, INC

Correspondence.

Poisonous Fish at Rotuma.

To the Editor of the Scientific American:

In the Jan. 2, 1886, number of your paper, I notice a letter from Mr. Robert S. Swanston, about poisonous fish in Rotuma or Rotuam. He states that "the fact was first noticed on the northwest side of the island, immediately after a hurricane," and that "the cause has gradually spread, moving east about," etc.

It is said by old fishermen that certain fish, sheepshead, for instance, will suck the moss, etc., from the copper-bound ships to an extent that the whole system will become impregnated with copper and the flesh become poisonous.

May it not be that a copper-bound vessel was wrecked on the northwest side of the island during the gale of 1884, and that the time taken for the spreading of the poison was only the time taken for the fish to find their way from the other parts of the island to this feeding ground? CHAS. W. FORSTER.

Georgetown, S. C., March 1, 1886.

Light at the Bottom of the Sea.

To the Editor of the Scientific American:

After reading in your issue of January 30 the interesting article written by Ralph S. Tarr under the heading, "How the Ocean Bottom is Lighted," and believing it to be still an unsettled question whether there is light or total darkness at great depths, I have wondered if any of the deep sea explorers have tried photography. It could be easily arranged to lower photographic plates placed at different distances on the sounding or dredge line. If there is light, interesting impressions might be obtained. Certainly it would help to establish the fact of light or darkness. If this method has not been thought of or tried, let your paper suggest it, and some salt water philosopher will try it. A sheet of sensitized paper inclosed in a bottle with an outer removable cover would be very simple, but perhaps not the best, as many more delicate methods could be devised. I offer this simply as a suggestion. C. MURRAY.

Springfield, Ill., February 2, 1886.

Diminished Rainfall.

To the Editor of the Scientific American:

Your recent editorial on the diminution of our average rainfall recalls statements made to me by the late Major Frank North, who had resided since childhood among the Pawnee Indians. They hold, it seems, a tradition that their ancestors came from the West, where they lived together in towns and cultivated the surrounding country. In time, however, they were compelled to leave their homes on account of a great drought, and migrated eastward. So great were their numbers that, in crossing the mountains, they wore deep trails in the rocky passes over which they journeyed.

The Pawnees boast that at one time they possessed a civilization equal to that of the white man. Major North stated that the sages who preserved these traditions could give no idea of the time of the migration, but from their accounts it must have been a long time prior to the conquest of Mexico by Cortez. One is forced to believe that drought and famine have been more powerful in depopulating the regions of the Colorado and Rio Grande than the marauding Apache or Ute. IRVINE A. FORT.

North Platte, Neb., Feb. 15, 1886.

Crude Rock Oil for Keeping Steam Boilers Clean.

To the Editor of the Scientific American:

Crude rock oil, *properly used*, will keep a clean boiler. With any kind of water within reasonable fitness for use, it will keep it in excellent condition, and free from scale or moving sediment; but the crude rock oil will not do all this unless the proper amount of blowing off be done, for it will not compass the neglect of attendants. The proper way to use the crude oil is to send it into the boiler through the feed water, only once a day, and only in very small quantities. One-half an ounce per day will keep an ordinary tubular boiler of fifty horse power as clean as possible; and after a few months of regular use the shell will be found as smooth as a piece of japanned work, provided it was not pitted at the start, and the tubes will be perfectly clean and smooth. The oil must be introduced into hot water, and for some reason it does its work better under pressure. If any "constant feeding" of the oil into a boiler takes place, the fire seams will commence to leak, for this has been tried; there seems to be a call for only a small amount of the oil, and the small amount *must not* be exceeded.

Parties who have used this "crude oil" for four to six years have in some cases experimented with the amount, and in every case an excess of oil caused a leaking at the seams, while a small amount produced the most complete cleanliness and immunity from scale. In a large plant under the advisory charge of the writer, the use of the "crude oil" has proved that it would loosen the scale rapidly; and in the case of an upright boiler, worked under one hundred pounds pressure, the scale became so rapidly freed from its hold on the tubes and firebox sides that a stop became necessary to clear out the leg of the boiler, and over five inches in depth of loosened scale was found in the water leg. In fourteen weeks another installment came out, and the coal consumed fell from 4,800 pounds to 3,200 pounds in the same time, the work done by the boiler being increased.

Some amusing instances might be related of putting in a "gallon of oil" at the cleaning of a boiler, on the supposition "it would last;" or of using tallow or sperm oil, or of some departure from the "crude rock oil," with a bare escape from serious consequences in two cases, and of "leaky boilers" in others.

"Crude rock oil" can be used in any boiler to advantage on the same principle as exemplified in the housewife's dinner pot—the oil or grease coats the surface of cast or wrought iron, and the pot becomes smoother than those not used for boiling greasy meats; but the steam boiler, under pressure and at a very much higher temperature, with a small amount of oil in motion through the circulation, becomes glazed, and being kept so by the minute particles of oil deposited, offers no chance for the scale to lay hold or to maintain a hold if one be acquired.

Many trials of crude oil in this way have been made in the New England States, especially in the large powers of cotton mills and manufacturing concerns, and its use is extending. THOS. PRAY, JR.

Recent Decisions.

Liability of Cities.—In the case of the city of Henderson *vs.* Weisenberger *et al.*, the Superior Court of Kentucky held that a city was not liable for injuries resulting from the falling of a billboard erected by the proprietor of a private lot and projecting over the line of his lot only the thickness of the board, unless the city had notice that the board was not securely fastened.

Contract with Municipality.—A contract entered into with a municipality, which provides for a certain mode of payment by the city, cannot be changed by subsequent legislation so as to authorize a performance different from that prescribed in the contract, and payments made in conformity with such subsequent legislation will not bind the contractor unless assented to by him. So held by the California Supreme Court in the case of McGee *vs.* City of San Jose.

Insurance.—An agent was employed to secure certain insurance, which he did. Afterward the insurance company gave notice to the agent of the cancellation of the policy. The general term of the New York Supreme Court held (Von Wien *vs.* the Scottish Union & National Insurance Company) that the notice so given was not notice to the insured, and that a clause in the policy to the effect that the insurance broker should be deemed to be the agent of the insured in any transaction relating to the insurance did not affect the question.

Right of State to Prevent Armed Assemblages.—A State of the Union has the right to prevent the armed assemblage of its citizens and their parading as military companies when not organized as such under the laws of the State or of the United States. So held by the Supreme Court of the United States in the case of Presser *vs.* the State of Illinois. To deny this right, in the opinion of the court, would be to deny the right to disperse assemblages organized for sedition and treason, and the right to suppress armed mobs, bent on riot and rapine.

Sale of Goods.—When a vender sells goods of a specified quality, but not in existence or ascertained, and undertakes to ship them to a distant buyer, when made or ascertained, and delivers them to the carrier for the purchaser, the latter is not bound to accept them without examination. The mere delivery of the goods by the vender to the carrier does not necessarily bind the vendee to accept them. On their arrival he has the right to inspect them to ascertain whether they conform to the contract, and the right to inspect implies the right to reject them if they are not of the quality required by the contract. Pope *et al. vs.* Allis, decided by the Supreme Court of the United States.

Right of Way.—A railroad company, in enforcing its right of way over the lands of others, and in constructing its road, is bound to leave the adjoining lands and fields which it crosses in the same condition as regards the facilities of cultivation and as concerns the utility of those lands to their owners as they were before the entry of the company. Hence a railroad company which constructs an embankment on the lands of a planter, and thereby stops up his ditches and other artificial drains, is responsible to such owner for all losses of crops and other damages occasioned by such interruption of his drainage. So held by the Supreme Court of Louisiana in the case of Payne *vs.* Morgan's Louisiana & Texas Railroad & Steamship Company, decided on the 5th January.

Trade Mark in Signs.—In the case of Sanders *vs.* Jacob, decided lately by the St. Louis Court of Appeals, it appeared that in 1871 the plaintiff opened an office for the practice of dentistry in St. Louis, under the title of the "New York Dental Rooms." He advertised under that name, and had it registered. In 1880 the defendant opened a dental establishment two doors from that of the plaintiff, using a sign in size and style similar to the one used by the plaintiff, and bearing the inscription "Newark Dental Rooms." The plaintiff brought suit to enjoin the defendant from using this sign, alleging that it was devised to deceive his customers and deprive him of business. The court granted an injunction, holding that it was apparent that the defendant used the sign to deceive the public and to attract the customers of the plaintiff.

Perils of the Sea.—The case of Pandorf *et al. vs.* Hamilton, decided lately by Lord Justice Lopes, of the English Court of Appeal, arose upon an action brought by the plaintiffs, as owners of a cargo of rice shipped on board the defendant's ship, for damage to the same by sea water. It was admitted that the damage in question was caused by sea water passing through a hole in a pipe supplying the bath room, which pipe had been gnawed by rats. It was also found that the defendant had taken proper precautions to keep down rats during the voyage, and that they had not been brought on board by the shippers while shipping the rice. The rice was shipped under a bill of lading which excepted "all and every dangers and accidents of the seas." Lord Justice Lopes held that as the immediate cause of damage was the action of sea water, which was itself one of the causes contemplated as an exception, and as the effective cause was the gnawing of the rats, which was as much beyond human control as if the pipe had burst from frost, the whole occurrence must be regarded as a peril of the sea for which the defendant was not liable as a shipowner. There being no negligence on the part of the defendant in not keeping down the rats, such an event, the Lord Justice said, should be taken to be an unavoidable accident, of the same kind as if a swordfish had bored a hole and so let in the sea water. —*Bradstreet's.*

Heat from Incandescent Lamps.

Herr Wilhelm Penkert, in the *Zeitschrift fur Elektrotechnik*, gives the following results of his experiments to find the quantity of heat emitted by different lamps, incandescent and other, in an hour:

	Units of Heat.
Incandescent Lamps:	
Siemens and Halske	427
Edison	355
Swan	430
Bernstein	153
Gas:	
Siemens regenerative burner	1,500
Argand	4,860
Two hole burner	12,150
Petroleum:	
Round burner	3,360
Small flat burner	7,200
Solar Oil:	
Schuster and Bauer's lamp	3,360
Small flat burner	7,200
Rape oil:	
Carcel lamp	4,200
Reading lamp	6,800
Paraffine candles	9,200
Spermaceti	7,960
Wax	7,960
Stearine	8,940
Tallow	9,700

With regard to the value of the Bernstein lamp, M. Penkert thinks that it is possibly too low, owing to the fact that in the measurements losses of heat were not absolutely guarded against. The construction of the lamp was such that it could not be entirely immersed in the water employed to determine the heat given out.

New York Bricks.

The forty-five brick yards at Haverstraw, N. Y., on the Hudson River, 32 miles above New York city, the largest brick making center in the country, with a capacity for making 340,000,000 bricks annually, turned out 300,000,000 in 1885, against a like number in 1884. About 2,000 men are employed, besides 300 in the river carrying trade, which keeps 44 barges and 50 small vessels busy. Haverstraw bricks are of ordinary grade, but bring 25 to 50 cents per 1,000 more than other bricks of like quality, owing to the excellent sand and clay used. They brought an average of $6 per 1,000 in New York last season, after paying $1 river freight and $1 to $1.25 per 1,000 royalty to the owners of the land where the yards are located. The works use in a season 42,000 cords of wood for heating kilns, at $5 per cord; 12,000 tons of coal dust, at $2 per ton; and 4,000 tons of coal, at $4.25 per ton; a total cost for fuel of $251,000. The total royalties were, as above, say $337,000, and wages (averaging $2.25 per day), say (six months), about $776,000. Two hundred patent brick-pressing machines, costing $1,000 each, are employed. The total gross receipts last year are given at $1,800,000. This particular industry began fifty years ago. At that time $3 per 1,000 was a fair price. Quotations have been as high as $9.

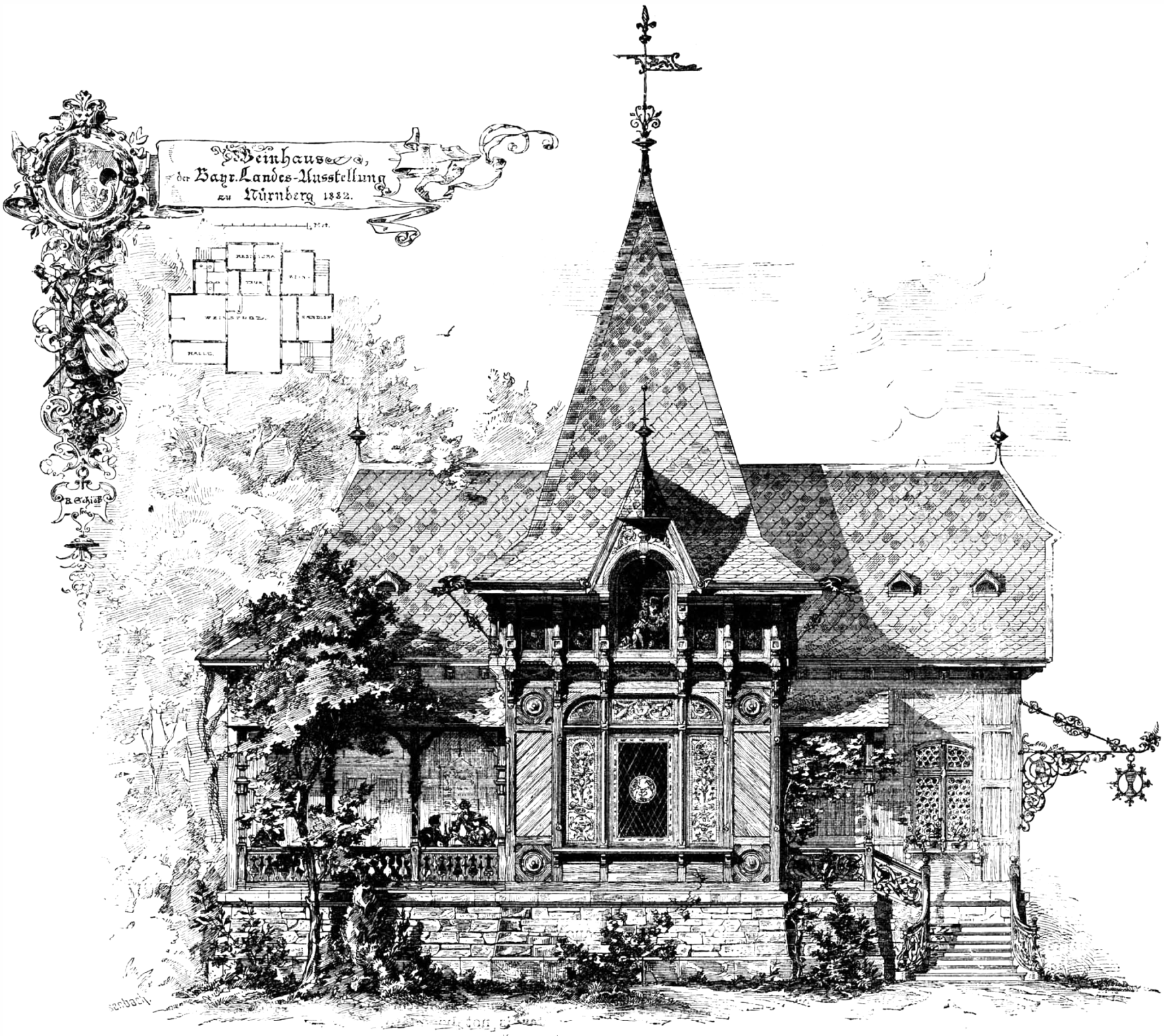
© 1886 SCIENTIFIC AMERICAN, INC

Discovery of a New Nebula by Photography.

MM. Paul and Prosper Henry have recently announced the discovery by means of photography of a new nebula in the Pleiades. It was first photographed on November 16 last, and, though it was again photographed on December 8 and 9, MM. Henry have as yet been unable to detect it by direct telescopic observation. The nebula is about 3′ in extent and "tres-intense." It presents a well marked spiral form, and seems just to escape Maia. Its position is as follows: R. A. 3 h. 38 m. 57 s., Decl. 24° 1′ N. The question is sometimes asked, Which is the most sensitive to light—the human eye or the photographic plate? This discovery seems to indicate the superior sensibility of the chemical plate.

DESIGN FOR A SUMMER GARDEN HOUSE.

Our engraving, for which we are indebted to *Architektonische Rundschau*, illustrates a much admired design for a summer refreshment house or casino, by Professor C. Schick, of Karlsruhe.



DESIGN FOR SUMMER HOUSE.—BY PROF. C. SCHICK, KARLSRUHE.

The Origin of Fires.

In speaking of the origin of fires, Dr. Nichols states that present investigations show that the number of fires attributable to incendiarism is much less than is generally supposed. Spontaneous combustion is another cause which has heretofore been brought forward on a great many occasions, when the real trouble has been in defective or careless construction. While dwelling houses in the United States are burning at about the rate of one every hour, and mills, hotels, stores, and barns are vanishing in proportion, it is worth the consideration of every householder to know whether his own premises are inviting destruction from fire, or whether they are reasonably secure from the ruin brought by that element. In the fire tables of 1884, incendiarism is placed at the top of a list of some twenty-seven causes. Next in this fatal list comes defective flues, but it is questionable whether they have been given the rank they deserve. Dr. Nichols mentions as a notable example of the complete carelessness possible in this direction, that the handsome residence of a neighbor got on fire three times within one month, and that on each occasion the narrowly escaped destruction was directly traceable to defective construction. In the first instance, fire was due to wood placed in connection with a steam boiler, and in the other two cases was caused by joists or beams brought in contact with chimneys when the house was built. In these cases sufficient heat reached the timbers to cause ignition.

There are many buildings in all parts of the country to-day where a little hotter fire than usual in furnace or grate will do just the same thing. Every householder should assure himself that no such danger menaces his own home or warehouse. Continued contact of wood with hot brickwork or heated currents of air will eventually cause combustion. There is but one remedy, and that is to remove the conditions. If a building is already erected, and these fire traps carefully concealed, it is a difficult matter to get at the source of danger and see that it is removed; but the difficulty is much less than that of starting anew when fire has carried off the household goods or destroyed the "plant" of a well established industry.

But while spontaneous combustion, being impersonal and therefore without the ability for defense, has had a great many sins laid to its door by builders whose volubility exceeded their carefulness, this peculiar process of slow oxidation has still a heavy account against it in the list of fire losses. In one instance, recalled by the same writer, a dwelling house caught fire by the spontaneous ignition of sawdust placed between kitchen floors as a sound deadener. The sawdust alone was safe enough, but when it became saturated with oil from the polishing of the floor above, new conditions prevailed. The sawdust heated rapidly from the absorption of oxygen by the oil. The temperature speedily rose to such a point that ignition occurred, and flame burst through into the room. For many years the conditions favorable to spontaneous combustion were so imperfectly known that no precautions were taken to avoid them. Now, however, they have been so well illustrated, together with the large possibilities of defectiveness in flues and chimneys, by a very complete list of catastrophes, that an intelligent builder—by which we mean not only the man who builds a house, but the man who has it built as well—must keep this experience in mind, and see that none of these fatal conditions is repeated in his own structure.

With twenty-seven recognized causes of fire, and any number besides, not classified, there are not a few otherwise careful persons who despair of the value of precautions, and trust the whole matter to fate and a heavy insurance. The wisdom of providing funds necessary for rebuilding is certainly commendable; but aside from any economic reasons why valuables should not be permitted to be thus quietly consumed, those who have gone through the ordeal of a fire, at either home or place of business, know that there are many things for the loss of which insurance is but a poor compensation.

Combustion of Copper and Nitrogen.

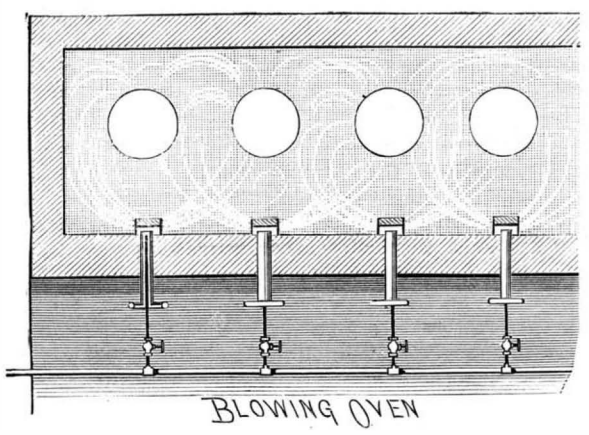
A curious phenomenon has been observed by M. Blondlot, and communicated to the French Academy of Sciences. A disk of platinum and a disk of copper, 0·03 meter in diameter, were fixed vertically in front of each other by help of two platinum stands. The disks were 3 or 4 millimeters apart, and both were placed inside a bell jar of porcelain, open below. The apparatus was then heated red hot for three hours, by means of a gas furnace, and although there was no electric current it was found that the face of the platinum disk was blackened with a deposit containing copper and platinum. In short, the copper had crossed from the copper plate to the platinum one. M. Blondlot, by repeating the experiment in different gas, found that the nitrogen of the air was the agent in this transport of matter. The nitrogen combines with the copper, and lodges on the platinum, either incorporating itself with the latter or decomposing in contact with it under the influence of its high temperature.

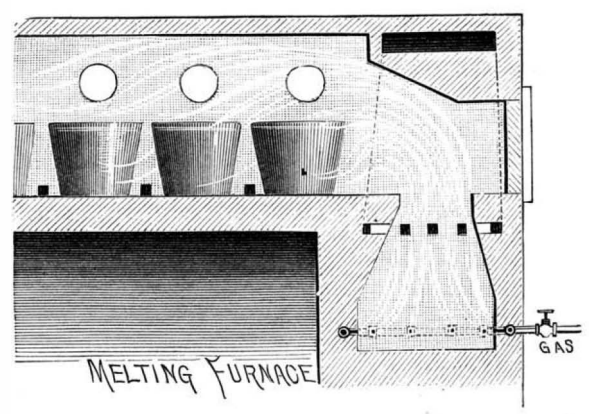
© 1886 SCIENTIFIC AMERICAN, INC

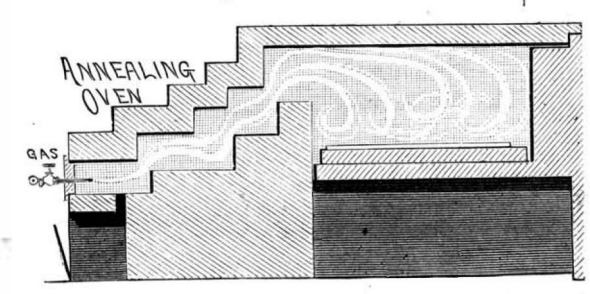
THE MANUFACTURE OF WINDOW GLASS WITH NATURAL GAS.

(*Continued from first page.*)

alkaline earth. The iron-master gets rid of the silica in his ores by making it into a fusible silicate of lime—an opaque glass. The assayer frees his metal from the accompanying gangue by adding suitable fluxes until







all the earthy matter is gathered into a fusible slag, and floats above the metal button as a molten glass. And even nature, when her interior caldron bubbles over in a volcano, shows that she, too, is a giant glass-maker. But to make good glass, clear, transparent, colorless, to simulate the purest water of a mountain stream, this requires skill and patience.

These two qualities are demanded in all stages of the operation. The first step is the manufacture of the crucible pots, and in this the glassmaker has a good opportunity to display these qualifications. The pots are made up of a mixture of about 2 parts raw fire clay, 2 parts burned clay, and 1 part ground pot shells, and require the greatest amount of care. The mixture is ground and thoroughly worked in a long trough, where it is turned once a day for a period of about four weeks. The workman kneads the plastic mass with his bare feet to make it tough and free from air. If the treatment is imperfect or careless, the entire subsequent work of the crucible will be unsatisfactory. The pots are formed entirely by hand, and in a room the temperature and humidity of which are kept as nearly constant as possible. They are all of one size, 33½ in. deep and 42½ in. across the top. The thickness varies from 3½ inches at the base to 3 inches on top, while the bottom of the pot is about 4 inches. The bottom having been first formed, the sides are gradually built up from day to day, the entire process requiring about six weeks. The capacity of the pots is from fourteen to sixteen hundred pounds of molten glass. When quite dry, they are placed in small heating furnaces, where the temperature is gradually raised to that of the melting furnace, and when this point is reached they are quickly transferred, and are then ready to receive the raw materials.

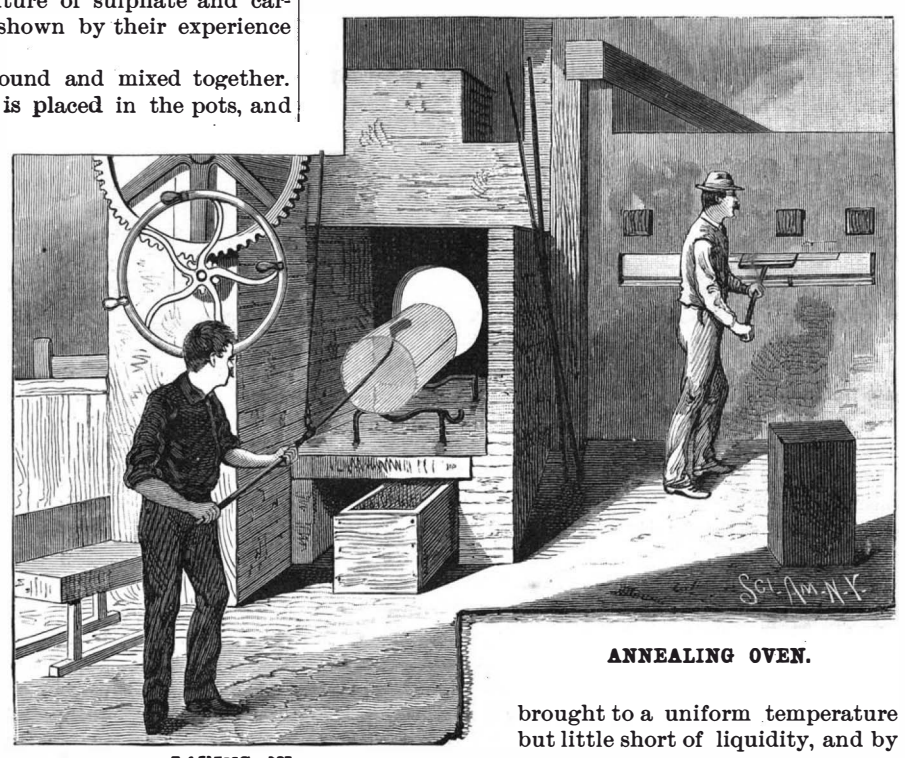
At the McKee works there are three melting furnaces, having a total capacity of 26 pots. These stand two abreast, one of the furnaces having 10 pots and the other two, 8 each. Round openings in each side of the furnace permit free access to each pot. The fuel, as everywhere else throughout the works, is natural gas. This is admitted at each end of the furnace, and is mixed with air which has been heated by passing through chambers in the fire-brick arch. A well is built under each furnace to collect the molten glass, should a pot break, and thus prevent loss of material or stoppage of the furnaces. The raw material, or "batch," introduced into the pot consists of: sand, 100 parts, lime, 30 parts; alkali, 40 parts; and a small but varying amount of pulverized charcoal. Some manufacturers make their alkali all sulphate of soda, while others employ a mixture of sulphate and carbonate, in the proportions shown by their experience to be the best.

These are thoroughly ground and mixed together. One-third of the full charge is placed in the pots, and after an interval of four hours a similar amount is added. With the last charge, introduced still four hours later, about two pounds of arsenious acid are added. This acts as a bleaching agent, and by converting the iron present into a higher oxide, removes the color to a large extent. At some establishments peroxide of manganese is used for this purpose, but a slight excess will give a pinkish color, and it also has the further disadvantage of making the transparency of the glass less durable. When the contents of the pots are quite liquid, and have settled down to a constant level, enough broken glass is added to fill the pots completely. This is known as the "capping." The entire melting occupies about 16 hours. During the latter part of this time, the heat is somewhat reduced in order to make the glass less liquid, and prepare it for gathering.

When the fusing period is completed, the surface of the molten "metal" must be freed from all impurities by skimming. For this purpose a fire-clay ring, introduced when the pot is first put into the furnace, floats upon the surface of the bath, and the gatherer, by removing all the scum from the interior of this ring, always has a clear surface from which to draw.

The gathering is done with a wrought iron pipe, about five feet long, the end of which is decidedly flared. Toward the mouthpiece, the pipe is surrounded with a wooden handle. The first dip brings out but a small lump of glass. By careful turning of the pipe, this is gotten into symmetrical, oval form. Three times the gatherer dips his pipe into the molten bath, each time getting a little more glass, until at the end he has a mass weighing from 15 to 20 pounds. If, however, window glass of double thickness is to be made, the metal must be gathered four or five times, and the resulting ball will weigh from 30 to 40 pounds.

It is at the final dip that the gatherer's greatest skill is called into requisition. The mass of red hot plastic glass must be gotten into symmetrical shape, and must be thoroughly homogeneous before it can be handed over to the blower. The pipe is therefore placed on a convenient fulcrum, the end carrying the ball of glass being in the furnace, and by depressing the handle and revolving the pipe the last glass added is made to completely overlap the former ball. The entire mass is



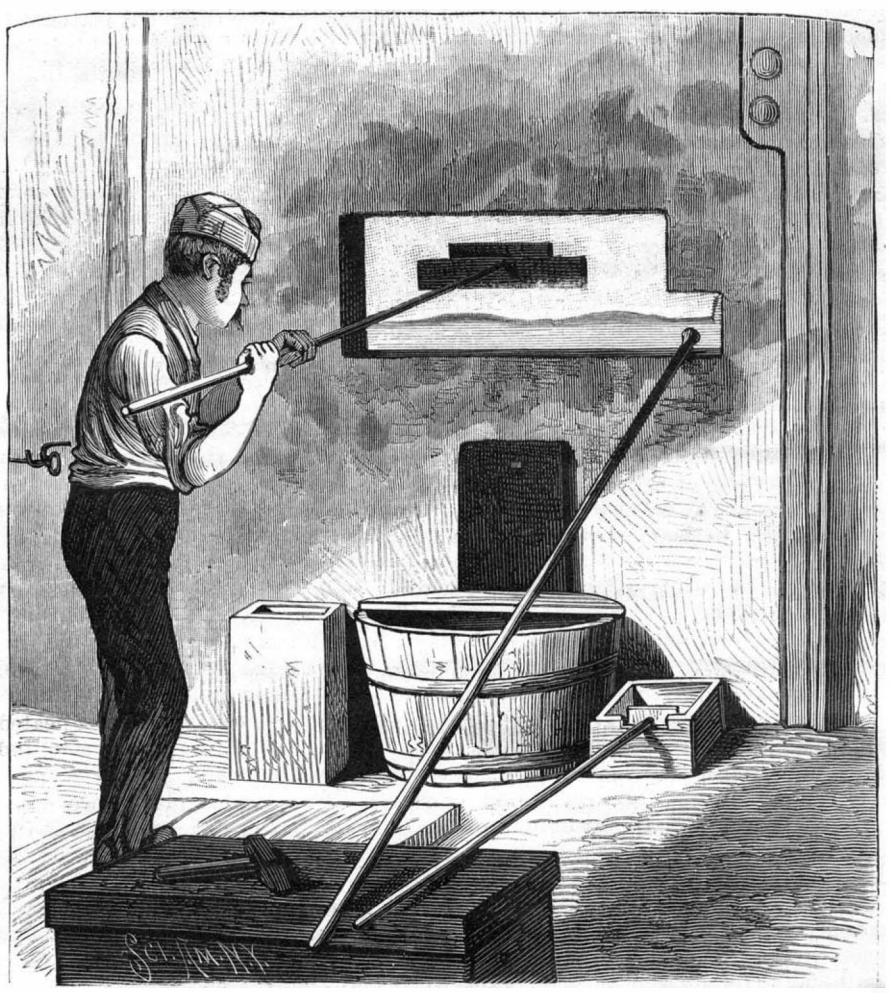
LAYING IN.

ANNEALING OVEN.

brought to a uniform temperature but little short of liquidity, and by a further revolution of the pipe the fold of glass formed by these manipulations is turned into a spiral and worked to the end of the mass. The ball of glass, red hot, and, if properly gathered, without flaw or blemish, is now taken to a wooden mould, shown at the right in our illustration of the blowing furnace, and by dexterous turnings is formed into a pear-shaped ball. The wood is kept from burning by being continually moistened with water, which, in contact with the red hot glass, assumes a speroidal condition, and looks like so many globules of mercury. The gatherer's duty is now ended, and he hands pipe and glass over to the blower.

Formerly, the melting and blowing furnaces were combined in one, but it has been found more economical to have them separate. The blowing furnace has the same side openings as the melting furnace, and simply provides an intensely hot chamber for controlling the temperature of the glass while being blown. The first act of the blower is to grasp the pipe, and with the ball of glass still resting in the mould, blow through the mouthpiece until a large bubble of air is formed in the mass of glass. Then, with alternate blowing and manipulating, he increases the bubble until the mass takes the shape of a large carboy, such as one uses for transporting acids.

The blower now transfers his operations to the platform in front of the blowing furnace, where long openings permit him to swing his pipe and globe of glass in a pit beneath. Blowing and swinging and reheating, he extends the bubble at the pipe's end, until, in place of the ungainly carboy, with its disproportionately thick bottom, he has a beautifully symmetrical figure, the shape of an enormous test tube. But during these operations it happens from time to time that the glass flows a little too freely, and the sides of the tube are in danger of becoming too thin. So the blower must occasionally throw his tube into the air and let the glass settle back upon itself. As the tube by this time is about 5 ft. long and from 15 to 18 inches in diameter, one can readily fancy that this apparently playful toss requires great skill and a large amount of muscle. In our illustration we have shown an even larger cylinder, one that when finished will furnish a pane 66 by 54 inches. The foremost figure of the group, who has thrown his heavy and bulky cylinder into the air with seemingly so little effort, is



THE MANUFACTURE OF WINDOW GLASS WITH NATURAL GAS.—FLATTENING.

© 1886 SCIENTIFIC AMERICAN, INC

the only man in the works who can manage so large a burden, for, in addition to its extra size, it is also double thickness.

When the tube is formed to the satisfaction of the blower, he permits it to become comparatively cool, thrusts the end into the furnace, blows into his pipe, and quickly covers the opening with his hand. A slight report is speedily heard. The confined air, expanding with the heat, has blown a small hole in the end of the tube. Resting his pipe on a suitable support, he gradually turns it around, while the hole grows larger and larger, until he no longer has a test tube, but a complete cylinder. Quickly he withdraws his pipe from the furnace, and allows the cylinder to depend into the pit below until the plastic edge passes to cherry red, and it can be taken away without danger of getting out of shape.

The blower has now finished his part, and he stands before you dripping with perspiration and apparently exhausted. But it takes him only a moment to recover his breath. Already another pipe is in his hand, and he is repeating his heavy labor.

A string of red hot glass adroitly drawn around the cylinder end causes an even crack to separate the neck and attached blowpipe from the cylinder proper. Then a hot iron is passed along the interior surface from end to end, and makes a longitudinal crack. As a cylinder, the glass looks as if it were pretty well ruined, with a crack running its entire length, but the process is only another step in its transformation into a window pane.

The cylinder is now ready for the laying-in furnace. This is in a separate building, and of late years has been made one of the most complete parts of the entire plant. The hearth of the furnace is circular, and is divided into several sectors, separated from each other by fire-clay bridges. As the hearth revolves, these sections pass through a corresponding number of compartments, in which the temperature may be varied at pleasure. The first compartment is only moderately heated, and is known as the laying-in oven. In this the cylinder becomes gradually warmed. A partial revolution of the hearth then carries it to the next compartment, the laying-out oven, where the heat is sufficient to make the glass plastic. On the floor of each section of the hearth a large flat stone, made of fire-clay and prepared with the greatest care, so as to be perfectly smooth, is adapted to receive the cylinder. While in the laying-in oven, the cylinder is supported by two brackets at the side of the stone; but as soon as it reaches the laying-out oven, it is removed to the stone, and, the crack being uppermost, is allowed to unfold until it lies open like a sheet of rumpled paper. It is then carried by the revolution of the hearth to the flattening oven, where a workman, as shown, irons out the plastic sheet until it lies perfectly smooth and flat. Further revolutions of the hearth carry the glass, now in a smooth sheet, to the dumb oven, where it slowly cools, and then to the entrance of the annealing oven, next door to the laying-in oven, making the circuit finally complete.

When the comparatively cool sheet of glass reaches this stage of its journey, it is picked up with a large two-pronged fork and placed upon a rod or bar projecting from the annealing oven. These rods are found an immense improvement over the car formerly used. They handle each sheet separately, and with the receipt of each fresh sheet they move the entire contents of the annealing oven toward the outer end, discharging a finished sheet at that end. The glass remains in the oven from 30 to 40 minutes. When discharged, the sheets are cut into proper sizes and stored in suitable frames.

The process is completed. The surface of the glass, just as it comes from the annealing furnace, is remarkably brilliant and as beautifully clean as if it had been washed in hot water and dried with linen. In all stages of the process the advantages of natural gas become each day more evident. The more intense heat of the new fuel gives a better fusion, while the contamination of the "metal," from particles of coal and cinder, is entirely avoided. It is, however, in the blowing furnace and flattening oven that the most marked advantages are obtained. With coal, the sheets of glass formerly came from the ovens coated with smoke, and, what was infinitely worse, with a white deposit of sulphur. As these impurities had been gathered while the glass was in a semi-plastic condition, no subsequent washing or acid bath could entirely restore the brilliant surface.

A comparison between new and old glass will make these differences very plain. But perhaps one can best appreciate the influence of gas upon the industry by glancing at the history of those establishments which are not so fortunate as to possess it. So radical, indeed, has been the change wrought by the new fuel, that several important glassworks in other parts of the country have admitted that the competition is too unequal, and have either suspended business or transferred themselves to the shadow of the nearest gas derrick. A number of such migrations have been reported during the past few months. It is a gratification to examine the products of such firms as the Messrs. McKee and others who have done so much to advance this industry, and to feel that our architects can now honestly recommend the use of American glass.

The Relations of the Government to Chemistry.

In a presidential address before the Chemical Society of Washington, Prof. F. W. Clarke recently reviewed the connection between the laboratory and the Government. While he finds a most encouraging growth in chemistry during the past twelve years, and an increasing disposition on the part of the Government to avail itself of chemical assistance, he also points out certain tendencies which at present menace the highest development of the science.

Nearly all of the departments of the Government are now provided with their own special laboratories, and in some cases it has been found necessary to devote several to the work of one department. With the increasing demands of a large industry, and the growing spirit of investigation, more laboratories will be needed. The development which these necessities involve requires, however, the advantage of a discriminating supervision if it is to afford the highest usefulness. The present chemical "plant" of the Government has not been the result of any definite plan. It is simply the outcome of every-day necessities, and, as such, it is without the organization needed for the prosecution of a great work. Much important apparatus is still wanting, while the scattered nature of the work has made the duplication of other portions necessary. In addition to this serious want of proper equipment, the Government chemists are severally called upon to do a greater variety of work than is compatible with excellence.

To uninformed officials, a chemist is simply a chemist; and as a consequence, problems of the most varied character are distributed among the different workers with an impartiality which would do great credit under other circumstances, but which in the present instance is nothing less than disastrous. The science is already so large that specialization becomes essential to success. With this scattering of effort and multiplication of poorly equipped laboratories, excellence will hardly be possible, for the range of work will be too broad and the appliances too meager. Prof. Clarke, therefore, strongly recommends a concentration of forces in one complete and thoroughly equipped national laboratory, divided into the proper number of departments, and presided over by a corps of skilled specialists. He also favors the union of the chemical and physical laboratories in one building and under one director, with facilities in both for scientific research as well as practical work.

Lanoline or Cholesterine Fat.

At a recent meeting of the Physiological Society, Berlin, Professor Liebreich gave a short sketch of a series of investigations which had engaged him for some years, and had led to the introduction of a new substance into the pharmacopœia. He premised that the denomination "fats" would have to cover more than it had hitherto done, and not merely such substances as were capable of decomposition into fatty acids and glycerine. All substances, on the contrary, would have to be conceived of as neutral fats which contained sebacic acids, no matter with what organic base these were combined. Such a neutral fat was discovered by Herr E. Schulze, in 1869, in the yolk of the fleece of sheep, and which consisted of a sebacic acid and cholesterine. This cholesterine fat of sheep's wool, or "lanoline," had been studied by Professor Liebreich, as to the method of obtaining it, on account of its excellent qualities in the way of a salve constituent. It was now being extracted from woolen hairs by means of a centrifugal machine, and had become an article of trade. Professor Liebreich had next investigated the origin of this cholesterine fat, and, with the help of the uncommonly sensitive cholestol reaction of Professor Liebermann, had come to the conclusion that the cholesterine fat contained in the yolk of sheep was derived neither from the sudorific glands nor from the sebaceous glands, nor from the sebaceous texture of the under skin, but was seated exclusively in the hairs and in the epidermis cells. This fact led, on the one hand, to the production of the substance as a kind of manufacture, while on the other hand it induced a very extensive series of experiments respecting the distribution of cholesterine fat in the animal kingdom. The speaker found it in the epidermis, the hairs, and nails of men, in the hairs of all mammalia he had examined, in the hoofs of horses, in the paws of swine, in the horns of cattle, in the prickles of the hedgehog, in the feathers of fowls, geese, and a large number of other birds, in the plated sheaths of the tortoise; in short, in all horned textures which, with long and toilsome labor, he had examined. The speaker had, in addition, found the cholesterine fat in the kidneys and the liver of mammalia; yet it was not beyond question that in these organs the cholesterine fat did not proceed from the blood, in which it was always present in small quantities. It might be conjectured that it would likewise be found in the intestinal canal, and generally wherever epithelial cells occurred. The constant presence in all epithelial formations of a particular fat, which was there formed in the keratine cells, rendered it highly probable that the hairs of the mammalia and the feathers of birds owed their elasticity and pliancy not, or at all events not exclusively, to the secretion of the sebaceous or caudal glands, but to the cholesterine fat generated in the horn cells themselves. The quality possessed by cholesterine fat of not oxidizing, or oxidizing only under very rare conditions, rendered it, as was very readily conceivable, most peculiarly adapted for lubricating the skin and feathers. Beyond the property of not becoming rancid, lanoline possessed a whole series of other advantages distinguishing it quite peculiarly as a salve constituent. It absorbed, for example, 100 per cent of water, and by so doing became a soft substance easy to the touch, penetrating the skin with altogether extraordinary facility, and, after but a short rubbing into the cutis, disappeared from view. Professor Liebreich had already prepared into salves a great number of medicamental stuffs by means of "lanoline," and had made experiments with them which yielded entirely satisfactory results. Lanoline, dark brown in a dry state, grew pale like wax in light, and showed other qualities besides, assigning it a place between the ordinary glycerine fats and the wax kind of fats.

Unconstitutional Tax on "Drummers."

In the case of Walling *vs.* the People of the State of Michigan, decided by the Supreme Court of the United States, on Jan. 18th, it appeared that the plaintiff in error was prosecuted in the police court of Grand Rapids, Mich., under a Michigan law imposing a tax upon persons engaged in the business of selling in that State liquor to be shipped from any other State. The plaintiff in error was a "drummer" for a Chicago firm, and was charged in one court with selling liquor at wholesale without a license, and in another with soliciting and taking orders for its sale without a license. He was convicted, sentenced to pay a fine, and imprisoned in default of payment. Upon appeal the conviction was affirmed by the Supreme Court of Michigan. The decision of the Michigan court has just been reversed by the Supreme Court of the United States, which holds that a discriminating tax imposed by a State operating to the disadvantage of the products of other States when introduced into the first-mentioned State is in effect a regulation in restraint of commerce among the States, and as such is a usurpation of the power conferred by the Constitution upon the Congress of the United States. The Supreme Court of Michigan held that the tax imposed by the act was an exercise of the police power of the State for the discouragement of the use of intoxicating liquors and the preservation of the health and morals of the people. The Supreme Court of the United States declares that this would be a perfect justification of the act if it did not discriminate against the citizens and the products of other States, and thus usurp one of the prerogatives of the national legislature. The court sums up its opinion as follows: "We think that the act in question operates as a regulation of commerce among the States in a matter within the exclusive power of Congress, and that it is for this reason repugnant to the Constitution of the United States and void."

Gresham's Injector.

Among the most interesting features of the machinery department of the recent Inventors' Exhibition, held in London, was the new automatic restarting injector, exhibited by the well known engineer and inventor, James Gresham, of Manchester. It received the first premium, and was selected by the managers to supply the boilers which furnished the steam for the motive power used in the exhibition. Among its most valuable points were its wide steam range, the injector working equally well and reliable at high and low pressures; its instantaneous and perfectly automatic performance, as soon as steam and water were turned on; and its restarting quality, which enabled it to take up the feed water at once, and without any handling of valves, after the supply had been withdrawn or interrupted from any cause whatsoever. This last feature seems to make the Gresham injector peculiarly adapted for the feed of boilers or traction and farm engines, and on tug boats and steam craft generally, where the supply of feed water is so liable to interruption from traveling over rough surfaces on the one hand, and from the motion of the waves on the other.

THE value of the hardware produced in the United States each year is now about $60,000,000, and half of it is made in Connecticut. This does not include firearms, agricultural implements, cut nails, or ornamental ironwork. These, with other articles which may be regarded by some as belonging to the list of hardware, would swell the total to far above $100,000,000. The manufacturers of England, France, and Germany send us about $2,000,000 worth annually.

© 1886 SCIENTIFIC AMERICAN, INC

BOLLEE'S STEAM CARRIAGE.

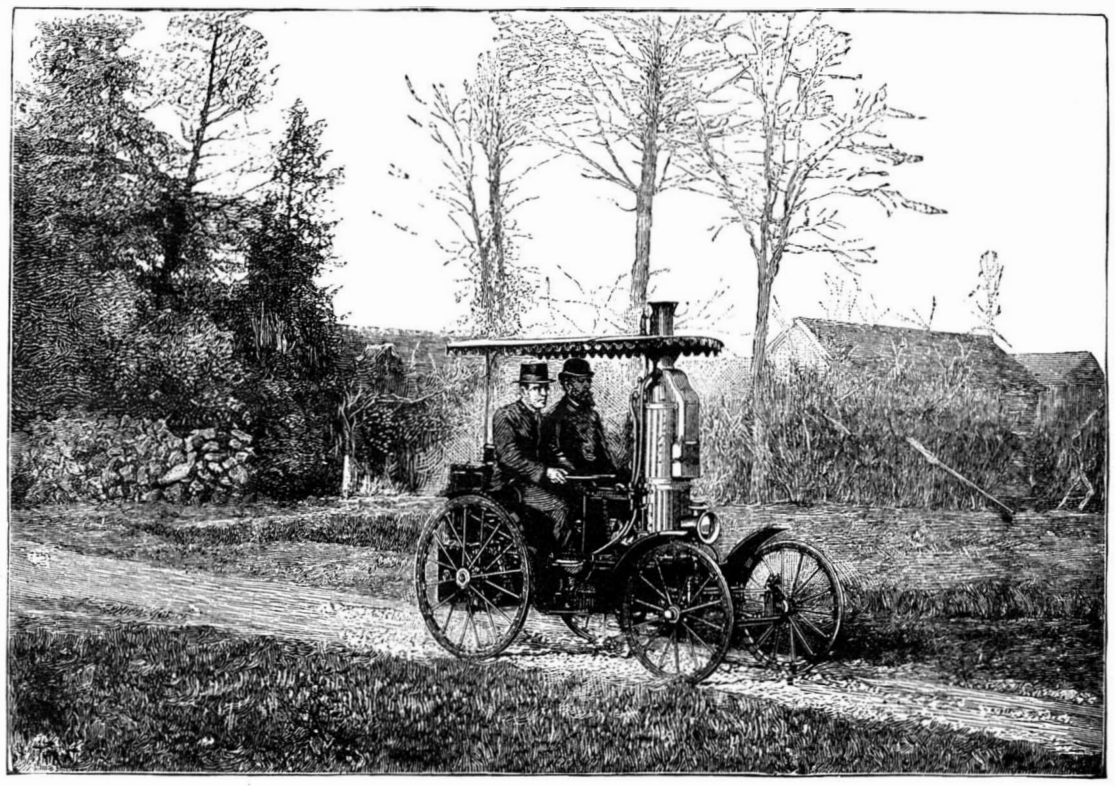
Mr. Amedee Bollee has just sent us a description of a small sized steam carriage that he has recently constructed and experimented with. We present an engraving of the apparatus made from a photograph taken by Mr. Sollier, an amateur at Mans, and, in addition, we give the details of construction that Mr. Bollee sends us.

The carriage frame, which is wholly of iron and steel, is 6¼ feet in length by 2¾ in width, and rests upon four steel wheels, through the intermedium of springs, so as to prevent jolting. The driving wheels, which are in the rear, are 3¼ feet in diameter, and are actuated by a differential motion, which, on curves, allows the two wheels to assume different velocities. The steering wheels are 2½ feet in diameter, and are peculiarly mounted, so as to render it impossible for the carriage to overturn, and to make the steering of it very easy.

The generator, which is placed in front, carries all the requisite apparatus. It is of a new system, that permits of a wide heating surface with little weight. It is very easily cleaned. It holds 7½ gallons of water—a relatively large bulk, that has the effect of keeping the pressure more regular. It easily develops a power of 2½ horses. On the trial trip the pressure was about one hundred and eighty pounds to the square inch, although the ordinary pressure is only about seventy. While running, the water is fed by a pump, and, during stoppages, by an injector. The motor, which is in the rear, is an expansion and reversible one, and has a power of 1,446 foot pounds.

The passengers, two in number, sit behind the boiler, and the one to the right has within reach all the apparatus necessary to run the engine. The fuel, which is stored at each side of the boiler, suffices for a run of sixty miles. The weight of the carriage, when empty, is 1,430 pounds. It easily ascends the steepest gradients, and its mean speed is 15 miles per hour. Mr. Bollee has several times obtained speeds of from 21 to 24 miles.

The apparatus may be given various forms and dimensions. In the fancy ones the boiler is in the rear.—*La Nature.*



BOLLEE'S STEAM CARRIAGE.

The Merchant Navy of the World.

The *Bureau Veritas* publishes the following statistics respecting the merchant navy of the world in 1885: The total number of sailing vessels in existence that year was 43,692, with an aggregate tonnage of 12,867,375; that of steamers was 8,394, with a tonnage of 6,719,101, making a total of 52,086 vessels and 19,586,476 tons. The largest fleet, naturally, is that of England, with 4,852 steamers, with a tonnage of 4,159,003, and 14,939 sailing vessels, of 4,714,746 tons. Next follows France, with 505 steamers, of 498,646 tons, and 2,173 sailing vessels, of 398,561 tons. Germany possesses 509 steamers, with a tonnage of 110,064, and 2,424 sailing vessels, with 863,611 tons. With regard to the importance of their steam navy, the maritime countries are classified as follows: England, France, Germany, United States, Spain, Holland, Italy, Russia, and Norway, which last country owns 103,792 tons of steam shipping. With regard to sailing vessels, the classification as regards importance is as follows: England, United States, Norway, Germany, Italy, France, Russia, Spain, Sweden, and Holland.

Use of Sandpaper.

In handling this subject, we expect to tread on the toes of both bosses and workmen. Still, we think a few suggestions will not be amiss. Sandpaper occupies a very important position; and, as it is more frequently used, and in greater quantities, than almost any other single article, it becomes a serious question as to cost. The workman, if so disposed, can materially reduce or increase the cost by using the paper up thoroughly or only using it half. We have seen some throw the piece away if only the edge was off the paper; others would use the edges and corners, and the center be good; and others, again, the center, and leave the corners good. That is a waste. As the paper is given to use, it is immaterial what shape you use it in, so that it has answered its purpose. It does no good to pile it up, or stow it away in a box to be used again; except in a very few cases, it never gets used again, and only accumulates for nothing. We generally use ours up until there is no virtue left in it, and then throw it away, either into the fire or into the waste box.

Now, we know there are some bosses who never seem satisfied unless they see a box of refuse paper around, and insist that we must use it, because it is to them like getting double service out of it. So they do, but at what a cost! Sandpaper, as bought by them, stands them in the neighborhood of about one-half cent per sheet. Divide that into, say, eight parts, which makes the cost about one-sixteenth of a cent per part. It is used until the cutting edge is off, and then thrown to one side. It has done all that can be expected from one-sixteenth of a cent. Now, to use it again will require at least two-thirds more time than at first. Say a man is getting 20 cents an hour; he can use the eighth part of a sheet up in about from five to ten minutes, according to the condition of the job he is doing. Give him ten minutes, and he has done, say, one-half of a large panel. Now make him do the other half with the same piece of paper, and I think I would not be far wrong when I place the time at half an hour, even if he could do it at all, which I doubt. The question is, Which is the more valuable, the paper or the man's time? In the first instance, the man occupies one-third of the half hour at a cost of 3⅓ cents in time and one-sixteenth cent in paper. To cover the same amount of surface with the same piece of paper again would bring the cost of the time occupied on the second half to 10 cents, from which might be deducted one thirty-second of a cent for the use of the old paper. In other words, trying to save one-sixteenth of a cent, we have actually lost twenty minutes in time and 6⅔ cents in money—enough to buy over thirteen sheets of new paper. As I said before, we use our paper as long as there is any virtue in it, and no longer. We turn and cut it up so as to get all there is of service in it, and then cast it away.—*Carriage Monthly.*

Electrical Surgery.

A student 22 years old, in the College of Burlington, Vt., slipped on the pavement about two months ago and strained his thigh. He soon lost the use of his left leg and suffered excruciating pain. He came to New York, was placed on a cot in the Post-graduate Hospital, and on January 25, Dr. J. Milton Roberts, a professor in the institution, performed on him a remarkable operation.

The young man was put under the influence of ether, and Dr. Roberts, with a scalpel, laid bare a portion of the hip bone about three inches wide. Then he called into play a bone cutting machine, invented by himself and called the electro-osteotome. It is worked by an electric battery and can revolve surgical instruments 12,000 revolutions, if necessary, in a minute.

The Doctor attached a small drill to the instrument and cut out portions of the hip bone up to its head, a distance of four inches. These pieces of bone under the microscope showed disease. The Doctor then used still larger drills until there was a space large enough to admit the entrance of a man's finger. He now wanted to see the exact condition of affairs inside of the bone. To do so he used a novelty for this class of work—a tiny incandescent electric light, about as big as a pea. This Dr. Roberts introduced inside of the passage in the bone, and the several flashes of light enabled him to see just where the diseased bone was. Then he took up his drill again, and cut out the diseased bone wherever it was necessary as easily as if the bone were open before him on an operating table. Dr. Roberts put in a drainage tube to take off diseased matter that might form, sewed up the wound, and applied antiseptic bandages. A hypodermic injection of morphine was given to the patient, and when he recovered from the effect of the ether he was in a satisfactory condition, and it is conjectured that he will in a comparatively short time be able to use his disabled limb.

Steel Ships.

As wood, in the construction of ships, was gradually replaced by iron, so iron, in its turn, is giving way to steel. The latter phase of the evolution has been very rapid. It is only seven years ago that steel began to attract attention as a substitute for iron in ship building. Its free use had just then been made possible—on the score of economy—by the perfection of the Bessemer process. But for the triumphant success of that cheap method of steel manufacture, such a thing as a steel hull would have remained the dream of naval architects. Seven years of trial have proved the advantages of steel over iron as a material for ships, as those of iron over wood had been previously demonstrated. The prime cost of vessels is increased by the change, but there is a great gain in durability, which makes the use of steel cheaper than that of iron in the long run.

The carrying capacity of a steel vessel is greater than one composed of iron. The tougher metal better stands the tremendous wear and tear of quick voyages. As to comparative safety in collisions with other vessels or with icebergs, the shock can be sustained with less damage to steel than to iron. For every exigency that taxes the strength of a hull, iron is less suitable than steel. It is rare that theory has been so well verified by practice. The position of steel as the material into which the navies of the world are destined to be transmuted in the early future seems now to be secure.

There is no known rival to steel in ship building. If aluminum could be produced as cheaply, its extraordinary tensile strength and its wonderful lightness would recommend it to such a use. But the great cost of its extraction from the superabundant clay in which it is found puts that use out of the question at present. After all the alleged improvements in its manufacture, its wholesale price was, at the date of the last government report on "Mineral Resources," not less than $6 a pound. And there is no other metal—or other material of any kind—from which steel has anything to fear as a competitor in the creation of a swift mercantile marine or an efficient war navy.

The Clyde statistics for 1885 tell the story of the gain made by steel on iron during the year. Of all the tonnage constructed and launched on the river last year, steel showed a percentage of 48. No further back than 1879 the percentage of steel tonnage produced on the Clyde was only 10¼. The proportion of steel to iron hulls has increased with great uniformity from year to year. The experience of the Clyde ship builders may be taken as that of all their craft.

The North German Lloyd now has three new steel steamers under headway at Govan, near Glasgow. The Havre line gives its orders for four more vessels of steel to the St. Nazaire shipyard in France. The descriptions of all these steamers show that they will be splendid additions to the steel fleet already in existence on the Atlantic. This revolution, now so silently but surely progressing, is not confined to Scotland or France. Every country which makes any serious pretensions to ship building assists in the transforming process.—*Journal of Commerce.*

California Soda.

Works have been begun at Owens Lake, in California. A portable engine is employed; and as soon as a vat is filled, the engine is moved to another, and the water is left to evaporate from the one that had been filled. This process will be repeated at all the vats until the soda sediment in the accumulating water in the pit reaches the surface. It will take about a year to get a crop of soda by this method, which will bring $35 per ton. It is expected that fifty tons of soda to the acre will be annually gathered. The number of vats will be increased till they hold an area of 50,000 acres of soda, the income from which is expected to be nearly $2,000,000 a year.

© 1886 SCIENTIFIC AMERICAN, INC

ENGINEERING INVENTIONS.

A railroad gate has been patented by Mr. James H. Pollard, of Clarence, Mo. This invention covers a novel construction and combination of parts in a gate, so arranged that an approaching train strikes a projection of a bar pivoted in connection with the rails, whereby the gate is automatically opened by the train, and is closed automatically after the train has passed.

A gate has been patented by Mr. Fred. W. Sensiba, of Talbot, Mich. It is intended especially for drawbridges, and is hung upon a shaft which is rotary reciprocated by connections from another shaft rotated by a weight and held from revolution by the end of a lever, with other novel features, whereby the gate will be automatic in its action so long as the weight is wound up.

A car seat recorder has been patented by Messrs. Joseph K. Bywaters and John G. Burke, of Paris, Texas. It is located in the middle of the car seat, the seat being thus divided into two parts, and is connected by gearing with the car axle, so that when depressed by the weight of a passenger it will record the number of miles traveled by the vehicle while the seat is so occupied.

AGRICULTURAL INVENTIONS.

A two horse hay rake has been patented by Messrs. Alexander Anderson and Robert Rutherford, of Brush Creek, Iowa. It is made with a truck connected with the reach frame of the rake by hooks on the reach frame engaging an annular plate, and a king bolt forming a fifth wheel, and provided with a hinged tongue, whereby all weight from the rake will be taken from the horses' necks.

A check rower has been patented by Mr. Jeremiah C. Butler, of Lexington, Mo. The shaft revolving wheel is secured on one and the marking wheel on the other end of a shaft journaled in suitable bearings above the runners, and the arms of the marking wheel are so curved that in leaving the ground they make a clear and distinct mark, the machine being very simple in construction and operation.

A cotton cultivator has been patented by Messrs. Joseph Wilkinson and Frank Curtin, of Kentuck, Ala. It is so constructed that front hoes will bar off and rear ones side up the cotton, while the chopping mechanism intermediate of said hoes will cut the cotton into stands, it being arranged so the frame carrying the cultivating and chopping mechanism may be lowered to cause the mechanism to operate in the ground to any desired depth.

A hay rack has been patented by Mr. Joseph A. Withrow, of Scranton City, Iowa. Combined with a central bar are transverse bars, adjustable angled rods, longitudinal bars, slotted curved springs and clips, with other novel features, so the rack may be readily applied to wagons for transporting hay and grain, and adjusted to wagons of different sizes, or it may be converted into a frame to receive a canvas covering for a wagon to adapt it for use by excursionists, etc.

MISCELLANEOUS INVENTIONS.

A windmill has been patented by Mr. Joshua G. Benster, of Duncan, Neb. This invention relates to solid vertical wheel windmills, and it provides for such construction as to be self-regulating in winds of widely varying force, while it is adapted for a variety of uses in driving small machines and for pumping.

A gate has been patented by Mr. Geo. A. Grant, of Eddyville, Iowa. It is composed of a number of wires hinged at one end to a fixed post and their opposite ends secured to a movable upright, the invention covering novel features in the construction and operation of such a gate.

A hame tug has been patented by Mr. John T. Condon, of Kingsley, Ohio. Its construction is such as to provide a strong pivot and one that prevents any rotary or twisting movement of the tug, which rests against the roll of the collar, while the tug stands out and will not dig into and wear the collar.

A roller skate has been patented by Mr. James B. Harris, Jr., of Geneseo, N. Y. It has a socket arm with an adjustable stop, the arm being fixed to and extending from one of the roller carriers, the object of the invention being to allow persons using roller skates to stop instantly or slacken speed at will.

A stand for photographic cameras has been patented by Messrs. William H. Lewis and Erastus B. Barker, of New York city. It is a camera tripod in which the legs, which are composed of three or more sections, are built up to give a regular tapering and firmer support for the stand, while the whole is very light and may be packed in small space.

A pen holder has been patented by Mr. Marshall J. Hughes, of Jersey City, N. J. The handle is split at one end, and has a clamping screw for drawing the parts together, with angled clamps for receiving ordinary pens, and arms in the slot of the pen handle, whereby ordinary pens may be used to make parallel lines at such distance apart as desired.

A gasometer has been patented by Mr. George E. Johnson, of Albion, Ind. It is designed for the use of dentists and others, for producing anæsthesia by nitrous oxide and other agents, and has a dry gas chamber, so the water forming the seal cannot absorb much gas, and the gasometer is small as compared with its capacity.

A mixing and vaporizing device for inhalers has also been patented by the above inventor. It is for thoroughly mixing anæsthetics, such as nitrous oxide or laughing gas and ether, at the time they are being used, and consists of a simple apparatus with chambers connected by bores with a common tube, with gauge, regulating screw, etc.

An exhibitor for paper hangings, etc., has been patented by Mr. Lewellen A. Ely, of Muir, Mich. Combined with an upright rod or tube, with a sleeve surrounding it, are frames hung on the sleeve, and handles on the sleeve for turning it, making a device for effectively displaying paper, borders, pictures, oil cloths, carpets, etc.

A mop wringer has been patented by Mr. Daniel Lynch, of Glens Falls, N. Y. It consists of a frame adapted to rest upon the top of a bucket or tub, and has two sets of fingers, one made to work toward and within the other to squeeze or wring the cloth of the mop as it is drawn through the two closed sets of rows of fingers, thus saving time and labor.

An umbrella casing has been patented by Mr Romeo E. Ghezzi, of New York city. It is formed of a series of telescoping tubes, making a shell to hold the covering and frame of an umbrella together very compactly, and which can be applied and removed quickly, serving when so desired as a drip cup for the water running down from the umbrella.

An embroidering machine has been patented by Messrs. Henry E. Schmitz and Edward Aldom, of Brooklyn, N. Y. It is a novel attachment for sewing machines, in which a single thread chain stitch is used to secure on the surface of the material to be embroidered a strip or length of cord, braid, chenille, beading, or other embroidering strip, of any desired color.

A machine for building wire fences has been patented by Mr. William H. Bigelow, of Worthington, Minn. It consists of a platform suitably mounted on wheels for moving from place to place, carrying an earth auger and means for driving posts, with apparatus for stretching and fastening as many wires as desired on the posts so driven.

A prairie fire extinguisher has been patented by Mr. Arthur W. Rumsey, of New Kiowa, Kansas. It has a water tank and beaters, so arranged that when propelled over the lines of a fire it will beat out and extinguish the fire at each side, and burn a swath or belt around haystacks, buildings, or farms, for protection against approaching fires.

A plastic compound to be used in the manufacture of burial caskets, furniture, etc., has been patented by Mr. Thomas Law, of Moulton, Iowa. It consists of rosin, black lead, sulphur, and rubber, melted and mixed together in stated proportions, that will readily mould and harden to make a waterproof and imperishable compound, and will also form an excellent cement.

A cotton chopper and cultivator combined has been patented by Mr. Joseph L. Murray, of Weimar, Texas. It has a cultivating plow located in the rear of the chopping apparatus, and in line with the point at which the chopping apparatus cuts out the row, whereby the cut out portion will be cultivated, and mechanism whereby the cultivating plow may be elevated over the stands of plants.

A head screen has been patented by Mr. Horace Garst, of Council Bluffs, Iowa. It is made of mosquito netting or fine gauze, in the shape of a bag, with a band at its upper end to fit upon a hat body, and a band at its lower end to fit loosely around the neck, with flexible weights at the lower edges, the whole so arranged that the screen can be raised and worn around the hat.

An attachment for rod rolling mills has been patented by Mr. Andrew J. Day, of Pittsburg, Pa. It is for use in connection with the ordinary form of rolls, and so designed that the rod, having once been delivered to the bite of the second pair of rolls, will take care of itself until the operation of rolling has been completed, avoiding the kinking which has heretofore required the careful attention of skilled workmen.

A lamp chimney cleaner has been patented by Mr. Andrew S. Reisor, of Reisor, La. It consists of a wire bent double and provided with a slip bar or loop, with a clamp wire hinged to the bend of the main wire and adapted to be locked on a pad or mop by means of the slip bar or loop, so it can be conveniently applied to the inside surfaces of chimneys or globes.

A feed mechanism for stone sawing machines has been patented by Mr. Francis H. Cook, of Rutland, Vt. It consists of cone-shaped spreaders arranged beneath the feeding tubes, with deflecting racks beneath the spreaders, and other novel features, whereby the sand or other abrading agent may be evenly distributed over a large surface, or confined to a particular portion when such delivery is required.

A door lock has been patented by Messrs. Garret G. Ackerson and Julius F. Shy, of St. Louis, Mo. The key holes for opposite sides of the door are out of line with each other, and the locking bolt has two key bit receiving notches, and there are also special key hole guard plates, making a simple and strong lock, not easily picked, and preventing peeping through key holes.

A gate has been patented by Messrs. William L. and John C. Wilson, of Cynthiana, Ind. A lever is pivoted to the lower rear part and extends diagonally upward and forward about to the top of the gate, a draw up rod connecting the lever with the upper rear part of the gate, with other novel features, to prevent the sagging of gates, and to hold their outer ends up any desired distance from the ground.

An electric leak alarm for pipes has been patented by Mr. Henry G. Bauman, of Pittsburg, Pa. It consists of a jacket inclosing the joint of a pipe, with a flexible metallic diaphragm and an insulated contact screw supported near the diaphragm, with electrical conductors connected with the pipe or jacket and with the insulating contact screw, to give alarm in case of leaks in the joints of pipes.

A signal horn has been patented by Mr. Charles A. Volke, of Stapleton, N. Y. It consists of a tube closed at one end, and with a neck at the other end, for connection to a steam or air pipe, the tube having a mouth at one side, below which it is divided by a bridge, making upper and lower chambers, connected by a narrow slit in the bridge, there being an adjustable valve for varying the tone.

A shutter fastener has been patented by Mr. Frederick A. S. Perry, of New York city. It consists of a latch adapted to be held in a slot in the blind, in connection with a spring and sliding jointed rod, and other novel features, whereby the blinds can be readily closed, and locked in place when closed, without extending the arm out of the windows to release them from their open position.

A beehive has been patented by Mr. William O. Vincent, of Newfoundland, Ky. This invention covers a novel construction and combination of parts, whereby a hive may be used to receive three distinct swarms of bees, or otherwise the bees can be allowed to pass back and forth between the brood chamber and the honey box, and the bees can generally be readily controlled and fed and protected from moths.

A fire escape has been patented by Mr. Theodore D. Jenkins, of Jersey City, N. J. A metal box has arms and guides for an escape line, with a lever arrangement, whereby, when the line is secured by one end in a window and the other end cast out, one may place a belt about the person, grasp a lever, and leave the window, the rate of descent being readily controlled by the lever.

A floor grinding machine has been patented by Mr. James B. Harris, Jr., of Geneseo, N. Y. A grinding wheel or block is fixed in a frame which also carries a seat for the operator, so that the weight of the latter can be thrown upon the grinding wheel, and the machine will abrade or level surfaces which it is drawn arross, being especially designed for leveling the floors of skating rinks.

A vehicle curtain has been patented by Mr. Joseph E. Bimm, of Dayton, O. The construction is such that the curtains can be so attached to the vehicle top that when not in use they are preserved from injury, and at the same time are ready and handy for use when required, and the arrangement is such that the entire vehicle top, with the curtains, can be made and trimmed up independently of the vehicle body.

A plate joint for stoves or ranges has been patented by Mr. Nathaniel A. Boynton, of New York city. Cast metal plates having parallel ribs are used in connection with sheet or wrought metal plates having marginal flanges bent to form an obtuse angle with their bodies, and arranged to fit within the grooves formed by the ribs of the cast metal plates, to make the necessary compartments and walls of the flues in a stove or range.

A composition for making sewer invert blocks has been patented by Mr. Samuel A. Miller, of Philadelphia, Pa. It is formed of hydraulic cement, sand, iron scale, or slag and iron, or steel sludge, the ingredients being thoroughly mixed with as small a quantity of water as possible; the composition is rammed down into a mould, and a mixture of one part of sand and one of cement is applied to the face of the bottom block of the mould, to give a hard and smooth finish to the top surface of the invert block, while the rest of the block is made to have great strength and durability, and to resist great pressure.

A machine for making stereotype matrix impressions has been patented by Mr. Friedrich Schreiner, of Philadelphia, Pa. It is designed for making impressions of each line successively on soft paper, from which a stereotype cast of the impressed sheet may be taken and used for printing, while an extra copy may also be obtained at the same time on tissue or carbon paper. A type case for use in connection with these machines has also been patented by the same inventor, and it holds the types in such a manner that as soon as they are released from the holder where used for taking an impression, they are automatically drawn back into the place which they had before.

NEW BOOKS AND PUBLICATIONS.

A HISTORY OF THE UNITED STATES, FROM THE DISCOVERY OF AMERICA, IN 1492, to 1885. By Emery E. Childs. New York: Baker & Taylor, 1885.

In a space of about 250 pages Mr. Childs has brought together a condensed account of American history, from the landing of Columbus to the World's Fair at New Orleans. It has been arranged in chronological order, and will be found a very convenient reference book. The main feature of the work is the careful record which has been made of important inventions, discoveries, the growth of national industries, and other matters of moment which have no direct political interest. It is a successful attempt to bring within the covers of a brief pocket edition about the same information that Professor McMaster has collected in his larger volumes, and will be appreciated by those who want a complete compendium in the fewest possible words.

THE HOLLY MANUFACTURING CO., of Lockport, N. Y., has issued a very attractive pamphlet, descriptive of the Holly System of Water Works and the Gaskill Pumping Engine used in connection with the system. It is designed to supply water to towns and cities without the use of reservoir or stand pipe. To maintain the required pressure in the mains, the operation of machinery is continuous; but as the demand for water is subject to constant variations, means are provided for the automatic regulation of the pumps, so that the amount of water delivered corresponds at any moment with the exact requirements. When the pressure in the mains falls below the standard, the regulator promptly acts to admit steam for a longer period into the cylinders; but when the pressure exceeds the prescribed standard, the action of the regulator is reversed, and less water is pumped. Another and important feature of the system is that by providing water under large pressure in the mains, the necessity of fire engines is avoided. The reports of the performance of the Gaskill engine are highly satisfactory. The pamphlet will possess considerable value for those interested in projected water works.

DESIGNS FOR STABLES. We have received from W. T. Comstock, of New York, "Thirteen Designs for Stables," being the third of a series of architectural designs of unusual merit. The plates, with specifications and details of construction, will be sent for $1.00 by the publisher, No. 6 Astor Place, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Deep Sea Wonders

exist in thousands of forms, but are surpassed by the marvels of invention. Those who are in need of profitable work that can be done while living at home should at once send their addresses to Hallett & Co., Portland, Maine, and receive free full information how either sex, of all ages, can earn from $5 to $25 per day and upward. You are started free. Capital not required. Some have made over $50 in a single day at this work. All succeed grandly.

For Sale.—$350 buys a new patent of a novel kitchen device. C. A. Bryant, Box 61, Wakefield, Mass.

Wanted.—A partner, with small capital, to work a new and paying invention. Address T. S. Le Grand, 712 Main St., Lynchburg, Va.

Bargain.—A Type Writer. W. E. Lewis, Corry, Pa.

Take a Pill

to regulate the bowels and drive away the sick or bilious headache which is the result of constipation. But don't rack your frame and overburden your organs by taking the old-fashioned great, drastic, griping pills. Science makes rapid advances, and Dr. Pierce's "Pleasant Purgative Pellets" are the result of careful study and skillful preparation. They are entirely vegetable, and operate without disturbance to the organs of the body, or to the occupation or diet of the patient.

Rubber Belting, Cotton Belting, Leather Belting, Economy Belting, Polishing Belting. Greene, Tweed & Co., New York.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. $100 "*Little Wonder.*" A perfect Electro Plating Machine. Sole manufacturers of the new Dip Lacquer Kristaline. Complete outfit for plating, etc. Hanson, Van Winkle & Co., Newark, N. J., and 92 and 94 Liberty St., New York.

Blake's Patent Belt Studs. The strongest and best fastening for Rubber and Leather Belting. Greene, Tweed & Co., New York.

Small Bench Lathes, with Countershaft, $16.00. Circular free. T. F. Welch & Co., 35 Batterymarch Street, Boston, Mass.

"Steel Stamps," J. E. Mathewson, Springfield, Mass.

Tools, Hardware, and other specialties made under contract. American Machine Co., Philadelphia.

Grimshaw.—Steam Engine Catechism.—A series of thoroughly Practical Questions and Answers arranged so as to give to a Young Engineer just the information required to fit him for properly running an engine. By Robert Grimshaw. 18mo, cloth, $1.00. For sale by Munn & Co., 361 Broadway, N. Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue will be ready in March.

Modern M'ch. Tools a specialty. Abbe Bolt Forgers, Power Hammers, Lathes, Planers, Drills, and Shapers. Send for estimates. Forsaith M. Co., Manchester, N. H.

Wm. Frech, Sensitive Drill Presses, Turret and Speed Lathes combined, Power Punching Presses, 68 W. Monroe Street, Chicago.

Order our elegant Keyless Locks for your fine doors. Circular free. Lexington Mfg. Co., Lexington, Ky.

Send for catalogue of Scientific Books for sale by Munn & Co., 361 Broadway, N. Y. Free on application.

Woodw'kg. Mch'y, Engines, and Boilers. Most complete stock in U. S. Prices to meet times. Send stamps for catalogues. Forsaith M. Co., Manchester, N. H.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Machinery for Light Manufacturing on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 142.

Nystrom's Mechanics.—A pocket book of mechanics and engineering, containing a memorandum of facts and connection of practice and theory, by J. W. Nystrom, C.E., 18th edition, revised and greatly enlarged, *plates*, 12mo, roan tuck. Price, $3.50. For sale by Munn & Co., 361 Broadway, New York city.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Dynamo Machines

for all purposes. Dynamo machines of highest efficiency, accurately calculated (as to capacity, etc.), and built to meet requirements in connection with all

Industrial Applications of Electricity,

including: Electric Lighting, Transmission of Power, Electro Mechanical Machinery, Electro Deposition of Metals, Electro Chemical Work, Telegraphy in place of Batteries, Electric Motors, of various horse power, to be run by Dynamo Currents. All dynamo and motor apparatus built to suit the work required and according to the best of known models for economy and efficiency.

J. H. Bunnell & Co.,
106 and 108 Liberty St., New York.

Curtis Steam Trap for condensation of steam pipes, high or low pressure. Curtis Regulator Works, Boston, Mass.

© 1886 SCIENTIFIC AMERICAN, INC

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 East 8th Street, New York.

Crescent Solidified Oil and Lubricators. Something new. Crescent Mfg. Co., Cleveland, O.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's ☞ Book of Saws free. Reduced prices for 1885. 50,000 Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa.

Hoisting Engines, Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

"How to Keep Boilers Clean." Send your address for free 88 page book. Jas. C. Hotchkiss, 86 John St., N. Y.

Barrel, Keg, Hogshead, StaveMach'y. See adv. p. 76.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 158.

Timber Gaining Machine. All kinds Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Manufacture of Soaps, Candles, Lubricants, and Glycerine. Illustrated. Price, $4.00. E. & F. N. Spon, New York.

Brass and Iron Working Machinery, Die Sinkers, and Screw Machines. Warner & Swasey, Cleveland, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. R. writes: We are about to lath and plaster a room in basement of store, to be used as a laundry. Can you suggest any way to effectually keep the fumes out of the store? A. Cover the ceiling upon the beams with tarred roofing paper well lapped, then fur and lath, or paint the ceiling after plastering.

(2) E. E. S. asks the cause of an engine knocking or thumping when oil or tallow is put in the cylinder? A. Possibly the piston rings are loose or have play between the head and follower. The lubrication giving them an easy motion, the inletting of steam at each end would send them alternately against the opposite shoulder.

(3) J. M. H. writes: Why does the iron made now rust so badly and decay, while the iron made many years ago rusts comparatively but little? A. The iron made 40 to 50 years ago in the United States was largely charcoal iron, and was purer and better than the same grades as made at the present day. Our common iron is filled with slag, and looks coarse and fibrous when rusted to show the grain. There is good iron made now at a price, such as the Swedes, Norway, and Ausable horse nail iron.

(4) F. H. L. asks: 1. What are the soft iron castings to be used for the electric machine described in SUPPLEMENT, 161, and how are they to be obtained? Are they malleable iron castings? A. The castings referred to are made from soft gray iron. They are better for the purpose than malleable iron. You can probably secure such castings in foundries in your own place. Malleable iron castings are unsuited to this purpose unless thoroughly annealed. 2. Is an armature wound with several coils much superior to that wound with one, and would it increase the power of the machine described in SUPPLEMENT, 161? If so, what number of coils would give the best results, and how would you construct the armature? Would it not be best to use a number of pieces of Norway sheet iron about one sixteenth cut in spur wheel form, and all fastened together and keyed on the axis, for the core? A. It would be difficult to construct an armature of the size referred to, with several coils, although a number of coils would undoubtedly increase the efficiency of the machine. For a small machine, we know of nothing better than that described in the SUPPLEMENT referred to. Your form of armature would be very good if for a larger machine than that described. 3. Can you suggest a better pliable insulator than silk coated with shellac varnish? A. We know of no better insulator than silk or shellac, or both, for wire.

(5) G. M. L. asks: How can I make an induction coil, such as are used in medical batteries, also what number of the SCIENTIFIC AMERICAN or SUPPLEMENT contains descriptions for making different coils? I wish to make a coil that will best operate on a Smee battery. A. To make an induction coil for medical purposes, use a magnetic core formed of a bundle of soft iron wires three-eighths of an inch in diameter and 4 inches long. Wind this with 3 or 4 thicknesses of writing paper, or place it in a suitable thin spool; wind on the spool 4 layers of No. 18 magnet wire for the primary. Wrap the primary coil with 2 or 3 layers of writing paper, and upon this wind 8 or 10 layers of No. 36 silk covered wire. SUPPLEMENT, 160, gives directions for making induction coils.

(6) J. D. L. writes: I wish to make an induction coil that will give an inch spark. Will one 6 inches long and 3 inches in diameter be large enough? The primary coil is 2 layers of No. 18 silk insulated copper wire; how much secondary wire will I need? How large and how many condenser plates will I need? A. We think your coil will be too small to yield a one inch spark. Better follow directions given in SUPPLEMENT, 160; it will cost little, if any, more to make a coil of that size. We cannotwithout considerable trouble give you detailed information for making a coil to give a spark exactly one inch long.

(7) G. A. C. writes: In the SCIENTIFIC AMERICAN of July 11, 1885, Note 1, there is a recipe for a cement which is proof against even boiling acids. Now, I wish to know if I can make battery cells of India rubber, say 2 in. square by 4 in. high, and cement with the above, so that they will last. If not, will you please inform me of a way to make them? A. By employing a cement made of gutta-percha, pitch, and shellac, equal parts melted together, you will be able to secure the corners of your battery cells together, successfully. We would advise, however, binding the corners with strips of soft rubber, attached by means of the same cement.

(8) G. S. B. asks: 1. Why does the cloudiness of the air and the number of rainy days in the year increase gradually from the equator to the polar regions, while the annual quantity of rainfall decreases in the same direction? A. Because the atmospheric currents move from the equator toward the poles, carrying moisture, which is precipitated from decreasing temperature, until finally, in the higher latitudes, the clouds near the earth are seen only in light drizzling rains. The fogs of the northern latitudes are mostly produced by the evaporation from the warm sea in contact with or into a cold atmosphere, which condenses the moisture to fog. 2. Why do fogs and clouds reign supreme in the polar regions except during the winter? A. Although there is much fog on the sea in high latitudes, their supremacy is a misnomer, prompted probably by comparison with sunny climes.

(9) J. D. C.—The belt has no influence upon the regulating power of the flywheel, whether it runs on the flywheel as a pulley or on a separate pulley. The placing of a belt upon the flywheel as a pulley or on a separate wheel or pulley is entirely a matter of convenience in arranging the transmission of power. The weight of flywheel and pulley on an engine shaft at their radius of gyration is the real measure of their equalizing power, although the belting and shafting of pulleys that are running regularly are an additional aid.

(10) V. W.—The eyebrows may be darkened permanently by the use of a silver hair dye, which can be obtained from any druggist. The dealers in ladies' hair, etc., will also furnish you with suitable preparation to use. For coarse skin, etc., we can only recommend you to consult with some competent physician.

(11) C. S. asks how to waterproof the tackle and rigging of vessels. A. Either of the following can be used: 1. India rubber in small pieces 1 ounce, boiled oil 1 pint; dissolve by heat, then add 1 pint hot boiled oil, stir well, and cool. 2. Melt in 1 pint boiled oil 2 ounces each of beeswax and yellow resin. These solutions should be used when warm.

(12) E. W. writes: I have a small engine, 2 inches bore by 3½ inches stroke. What size boiler is necessary, and how is the best way to make? A. Your engine will give you a half horse power with 75 pounds steam. You will require a boiler having 10 square feet of heating surface; a cylinder of three-sixteenths inch iron, 16 inches diameter, well riveted, 2 feet long, with 20 tubes 1 inch, heads ¼ inch. Set vertical on an iron furnace lined with firebrick, such as used in stoves, with a sheet iron cap on top of boiler and stove pipe to chimney. Water gauge and gauge cock on side of shell. Take steam from top of shell.

(13) F. W. G. asks: 1. What amount of weight would borts or black diamonds (when set in drill bits) hold up without crushing? Suppose the bit stood on rock, and the pressure was downward, from weight of drill rods upon the bit. A. The borts will not crush when the drill rods stand upon them in the drill hole or on ordinary stone, always provided that care is used in letting the rods and bit down, so as not to hammer the borts out of their sockets; also not to turn the bit when great weight is on it, which may also tear the borts out of their setting. 2. At what speed are diamond drills generally rotated when boring ordinary rock? A. The speed of the periphery of diamond drill should be from 50 to 75 feet per minute. 3. What amount of twisting or torsion strain would 3 inch lap-welded gas pipe stand if made from good iron? A. The torsional strength of 3 inch gas pipe is 4 tons at 1 foot from center. Its safe working strain is one-quarter of this. The coupling joint is not considered in this figure.

(14) A member of the House of Representatives, U. S., asks the materials, quantities, and manner of making the starch by which laundries put the fine polish on shirt bosoms, etc. A. This information is given in answer to query 7 in SCIENTIFIC AMERICAN for December 12, 1885, and has frequently been published by us.

(15) J. P. P.—It is extremely doubtful if you can rip 1½ pine and hard wood with a 6 or 8 inch saw with any speed or comfort. You will find it hard work to cut half through by foot power. You can rabbet with a wide saw or a wabble saw. We can recommend "Art Furniture Designs," 4to, $3.00; Eastlake's "Hints on Household Taste," 8vo, $3.00, which we can furnish.

(16) E. R. B. asks: Does the bile ever enter the stomach? If so, does it remain long enough to be a cause of biliousness? A. The hepatic duct, which conveys the bile from the liver, opens, not into the stomach, but into the intestine, at a distance of some inches below. There is normally, therefore, no bile ever in the stomach, but it is abnormally often thrown backward into it, and thus produces irritation and nausea. Bilious vomiting is not a cause of biliousness as the term is used; it is the result of it.

(17) J. C. S. asks the materials used in the manufacture of a paint sold under one of the special trade marks used by paint combinations which the trade has on sale. A. We cannot be expected to know their ingredients, nor to state their peculiarities in these columns, if we did know them. We do not consider any of them equal to pure white lead and oil. The spurious whites made to imitate white lead mostly have baryta for their base, mixed with cheap white earths for bulk. We consider them dear to use, cheap to sell.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

F. B.—The specimen is pyrite, or sulphate of iron. It has no value.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

March 2, 1886,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Aerial navigation, ship for, L. A. Beardsley 336,984
Air compressor, hydraulic, W. Thomas 337,209
Alarm. See Electric leak alarm.
Amalgamator, J. Wilkins 336,970
Anchor, T. S. Calpin 337,241
Animal trap, L. J. Hauserman 336,998
Ash pan, J. H. McKeown 336,934
Axle lubricator, car, W. H. Herbertson 337,327
Back band hook, S. Ward 337,215
Baling press, W. S. Bryan 337,237
Band tightener, J. Reid 337,081
Barrel, wooden, W. M. Allyn 337,110
Battery. See Secondary battery.
Bed bottom, spring, M. C. Silver 337,206
Bedclothes holder, F. P. Sargent 337,200
Bed, folding, Horn & Hopf 337,158
Bedstead, cabinet, Cochrane & Kirk 336,993
Beehive, W. O. Vincent 337,097
Bell, call, W. C. Homan 337,157
Belt reel, D. B. Kuhn 337,002
Belting, machinery, R. F. M. Chase 336,990
Bending block, D. C. & J. G. Mahon 337,006
Bicycle lock, A. P. Merrill 337,183
Bicycle saddle, F. Lillibridge 337,171
Billiard chalk holder, W. E. Davis 337,311
Binder for papers, temporary, E. L. Shipman 336,954
Biscuit cutter, R. J. Hewitt 337,329
Blind and wire screen, combination of, F. A. Ransom 336,944
Blind slat adjuster, R. M. Martin 337,275
Blind, window, H. Hawley 337,152
Block. See Bending block. Horse block.
Blotting pad and memorandum book, combined, H. C. Whitney 337,101
Board. See Siding and roofing board. Washboard.
Boat. See Fisherman's minnow boat.
Boiler. See Steam boiler.
Bolt holder and pipe wrench, combined, A. W. Becker 336,985
Book cover and removable leaf, combined, E. W. & J. F. Snow 337,027
Boot drier, Brewster & Sherwood 336,987
Boot or shoe, rubber, J. S. Owner 337,190
Boot or shoe sole, E. S. Harris 337,060
Boots or shoes, machine for making box toes and stiffeners for, Riedell & Litch 337,082
Bottle stopper, A. Luedemann 337,003
Bottle washer, G. J. Fritz 337,054
Bottle washing machines, brush holder for, J. M. Hoyt 337,332
Box. See Signal or call box. Toy money box.
Brake. See Car brake. Vehicle brake.
Brick machine, F. Doerfler 337,137
Bricks, etc., drying shed for, O. McCoy 337,180
Broom holder, A. D. Stansbury 337,091
Brush, electrical, J. D. Culp 336,897
Bung, barrel, H. Roemhildt 337,084
Bung for beer kegs, casks, etc., W. W. Jackson 337,162
Bung, venting, F. R. & G. W. Tibbitts 337,211
Burner. See Gas burner. Lamp burner.
Button fastener, G. W. Prentice 336,943
Buttons, making, F. A. Smith, Jr 336,955
Buttons to garments, fastening for attaching, Powell & Nolan 337,195
Cabinet, L. F. Gerbing 337,055
Candy, apparatus for cooling and heating, T. Burkhard, Jr 337,303
Car brake, P. A. Gambaro 336,911
Car brake and starter, J. F. Morell 337,278
Car coupling, A. N., Jr., & A. L. Gabel 337,257
Car coupling, J. H. Harrington 337,150
Car coupling, G. M. Veteto 337,096
Car coupling, F. E. Rousseau *et al* 336,950
Car, motor, R. N. Allen 337,109
Car, railway, R. H. Wyman 337,106
Car seat recorder, Bywaters & Burke 337,305
Car starter, W. H. Johnson 336,922
Car, stock, G. D. Burton 337,240
Car, stock, G. Grossman 337,323
Car wheels, machine for rolling, T. W. Bean 337,230
Cars, track sanding apparatus for street, W. T. Butler 336,891
Card cutting machine, W. A. Kelsey 337,270
Carpet cleaning reel, Miller & McKenna 336,936
Carpet cover, F. Sanderson 336,951
Carpet sweeping machine, C. L. Travis 337,288
Carriage, baby, C. Lyne 337,343
Carriage body, J. Delahunty 337,252
Carriage curtain fastening, J. G. English 337,140
Carriage spring, R. B. Williams 336,971
Carrier. See Hay carrier.
Cart, dumping, B. McGregor 337,011
Cart, road, J. D. Wilson 336,973
Cartridge loading machines, wad feed attachment for, O. F. Belcher 337,117
Case. See Honey box case.
Centrifugal machine, J. Laidlau 337,166
Chain, drive, J. A. Jeffrey 336,921
Chair. See Child's chair. Reclining chair.
Chart, dress, J. Penley 337,016
Check rower, J. C. Butler 337,301
Child's chair, F. A. Parker 336,942
Chimney cowl, H. F. Seidel 337,022
Chuck, brace, J. Chantrell 337,243
Churn, L. D. Bunce 337,238
Cigars, machine for stamping, L. Grathwol 337,322
Clamp. See Floor clamp.
Clasp for poultry, game, etc., suspension, Schussler, Jr., & Fredericks 337,019
Clipper, hair, S. W. Burwell 336,890
Clock, electric alarm, C. Korfhage 337,067
Clock striking mechanism, A. Fischer 336,995, 336,996
Clothes line stretching device, F. Schweizer 337,020
Clutch, C. S. Scott 337,021
Clutch, friction, W. B. Tatro 337,032
Coat hanger, M. R. Maxwell 337,345
Cock, gas, E. P. Irons 337,161
Cockle and grain separator, J. B. Dishmaker 337,051
Coffin, J. Maxwell 337,009
Cold and manufacture of ice and apparatus therefor, production of, A. Schmitz 336,952
Cold storage chamber or refrigerator, G. C. Roberts 336,949
Collar, G. N. March 337,176
Collar, G. K. Snow 336,957
Collar, horse, P. R. Turneaure 336,964
Colter, rolling, S. W. Ball 337,295
Comb. See Curry comb.
Compass attachment for maps, J. Adler 336,883
Connecting pin, expansible, H. M. Montgomery 337,072
Copying roller, J. B. Leckie 336,926
Corkscrew, W. Crabb 337,309
Corn husker, J. P. Withrow 336,974
Corn husking device, N. Evinger 337,141
Coupling. See Car coupling.
Cowl. See Chimney cowl.
Crane, portable window, A. Anderson 337,225
Cream separator, W. H. Johnson 337,266
Cultivator, F. H. Austin 336,884
Cultivator, D. & R. B. Motherwell 336,939
Cultivator, cotton, Wilkinson & Curtin 337,222
Curtain fixture, G. H. Baker 337,043
Curtain pole ring, A. D. Field 337,053
Curry comb, T. Gingras 337,057
Cut-off valve, J. P. Simmons 337,025
Cutter. See Biscuit cutter. Stalk cutter. Strawberry runner cutter. Vegetable cutter. Wire cutter.
Damper, stove or range, A. M. Blakesley 337,233
Digger. See Potato digger.
Dish, soap, A. M. Hayward 337,153
Disinfecting device, A. H. Kidney 337,164
Display rack, J. A. Miller 336,985
Distance registering device for wheeled vehicles, E. S. Brownson 336,989
Distilling oil, process of and apparatus for, Norton & Rouse 336,941
Door lock, Ackerson & Shy 337,108
Door lock, W. Bohannan 337,044
Draught regulators, safety apparatus for automatic, C. W. Nason 337,013
Drawing and twisting, head for continuous, D. O. Pease 337,015
Drier. See Boot drier. Grain drier.
Drill. See Fork drill.
Drills, machine for clearing twist, J. A. Morton 337,279
Electric battery cell, J. W. Carter 337,045
Electric current meter, Borel & Paccaud 337,123
Electric leak alarm for pipes, H. G. Bauman 337,116
Electric light fixture, S. Bergmann 337,296
Electric lighting circuit, R. Mackie 337,005
Electric lighting system, Mackie & McCarty 337,004
Electric machine, dynamo, F. Bain 337,041
Electric machine regulator, dynamo, N. Tesla, 336,961, 336,962
Electric machines, armature for dynamo, F. Bain 337,042
Electric machines, circuit connection for dynamo, N. McCarty 337,010
Electrical conductor, H. A. Clark 336,992
Electrical machine, frictional, A. L. Robbins 336,947
Electricity for destroying living organisms in the bodies of slaughtered animals, applying, C. S. Jones *et al* 337,334
Electrolier, extension, J. T. Robb 337,199
Elevator. See Water elevator.
Elevator bucket, H. B. Haigh 336,916
Elevator safety attachment, H. R. Ferris 337,317
Elevator safety device, A. O. Wuensche 337,355
Embroidering machine, Schmitz & Aldom 337,088
Engine. See Gas engine. Hydraulic elevator engine. Hydrocarbon engine. Rotary engine. Steam engine.
Envelope machines, drying attachment for, E. H. Woodford 336,976
Evaporators, apparatus for automatically feeding liquids to, M. C. Barden 337,227
Excavating apparatus, odorless, P. F. Dewey 336,902
Extension key, J. H. Shaw 337,203
Extension screen, adjustable, T. C. Peck 337,192
Fabric turfing implement, M. A. Rafter 337,196
Fabric turfing machine, M. F. Connett, Jr 337,306
Fare boxes, money drawer for, W. H. Harrison 337,262
Fastener, metallic, G. W. McGill 337,182
Faucet, force and drain, F. R. Tibbitts 337,210
Feed water heater, J. Mahoney 336,929
Feed water heater, O'Brien & Weaver 337,189
Fence post, J. Burns 336,889
Fence stay, wire, W. C. Gholson 337,259
Fences, machine for building wire, W. H. Bigelow 337,119
Fertilizer distributer, J. H. & T. Dodds 337,312
Fifth wheel anti-rattler, J. Long 336,927
File, bill and letter, J. S. Vanhorn 337,213
File handle, J. Chantrell 337,244, 337,245
Filing device, bill and letter, J. S. Vanhorn 337,214
Filter, centrifugal, R. L. De Lisser 337,050
Filtering device for feed water pipes, J. Heath 337,154
Fire alarm boxes, attachment for, H. H. Rebbeck 337,198
Firearm, G. W. Cilley 336,894
Fire escape, J. Bien 336,887
Fire escape, J. D. Jenkins 337,064
Fire extinguisher, hand grenade, A. E. Lytle 337,344
Fire extinguisher, prairie, A. W. Bumsey 337,086
Fire extinguishing projectile, W. A. Bartlett 336,981
Firepot, tinner's, J. Carter 336,898
Fisherman's minnow boat, F. F. Ward 336,967
Fishing hook and device for capturing fish, Scotland & Cordon 336,953
Fishing lines, reel for drying, J. W. Brooks, Jr 336,888
Floor clamp, B. Page 337,191
Floor grinding machine, J. B. Harris, Jr 336,918
Flooring, flexible, Adams & Hasson 337,292
Food for animals, preparing, C. H. Voigt 336,965
Fork drill, C. Snedekum 337,351
Frame. See Picture frame.
Fruit, flowers, etc., device for picking, J. S. Langhorne 337,168
Gas and obtaining ammonia and other products therefrom, purifying coal, C. F. Claus 337,246
Gas apparatus, Gogin & Jones 336,912
Gas, apparatus for the production of pure sulphurous, F. Randon 337,197

© 1886 SCIENTIFIC AMERICAN, INC

Gas burner, regenerative, H. C. Campbell..... 337,130
Gas, electrical torch for lighting, J. D. Culp..... 336,898
Gas engine, G. C. Anthony..... 337,226
Gas regulator, J. E. Miller..... 337,012
Gas supply pipe, G. Russell..... 337,350
Gasometer, G. E. Johnson..... 337,065
Gate. See Railway gate.
Gate, G. A. Grant..... 337,148
Gate, F. W. Sensiba..... 337,089
Gate, W. L. & J. C. Wilson..... 337,104
Generator. See Steam generator.
Glassmaker's mould, F. S. Shirley..... 337,204
Glassware, E. D. Libbey..... 337,170
Glassware, decorated, A. Hamprecht..... 337,324
Glassware, manufacture of decorated, A. Hamprecht..... 337,325
Grain binder, P. P. Coler..... 336,895
Grain drier, Ehlermann & Mayer..... 336,905
Grain hulling and scouring machine, F. B. Rolle.. 337,284
Grain separator and cleaner, J. P. Bond..... 337,234
Grinding mill, J. B. Allfree..... 336,979
Guitar, J. Klueber..... 337,337
Gun barrels, machine for finishing, J. M. Clough.. 337,247
Gun, magazine, A. Burgess..... 337,239
Hame, J. F. Knorr..... 337,338
Handle. See File handle. Tool handle.
Hanger. See Coat hanger.
Harness ring holder, G. W. Swinehart..... 337,031
Harrow, A. C. Evans..... 336,906
Harrow, J. A. Minger..... 337,186
Harrow, disk, Phelps & Swift 337,017
Harvester and binder, Whiteley & Bayley..... 337,220
Harvester reel, A. Stark.. 336,959
Harvester reel, adjustable, J. H. Borse..... 337,285
Harvesting machine, cotton, C. T. Mason, Jr..... 337,007
Harvesting sack supporter, J. E. Poteet..... 337,194
Hat and coat hook, wire, F. Taylor..... 336,960
Hat ventilator, F. C. Bowen..... 337,124
Hay carrier, W. Louden..... 337,173
Hay loader, L. H. Robbins..... 336,948
Hay rack, J. A. Grassman..... 337,321
Hay rack, J. A. Withrow..... 337,105
Hay rake, two-horse, Anderson & Rutherford.... 337,111
Heater. See Feed water heater. Hot water heater.
Holder. See Bedclothes holder. Billiard chalk holder. Bolt holder. Broom holder. Harness ring holder.
Honey box case and clamp, O. S. Foster..... 337,143
Hook. See Back band hook. Fishing hook. Hat and coat hook. Whiffletree hook.
Horse bed, automatic, T. M. McDonough..... 337,070
Horse block, W. N. Bell..... 336,986
Horse rake and carrier truck, combined, J. H. Barley..... 337,228
Horseshoe, W. Somerville, Sr..... 337,090
Horseshoes, tool for expanding, H. Wilcox..... 337,221
Hose spanner, F. W. Gray..... 336,915
Hot water heater, H. K. Kriebel..... 337,068
Household press, J. L. Smith..... 336,956
Hub, wheel, French & Maltby..... 337,319
Hydraulic apparatus, L. Belder..... 337,118
Hydraulic elevator engine, J. Gibbins..... 337,056
Hydrocarbon engine, J. P. Holland..... 337,000
Ice elevators, slush remover for, J. S. Field..... 337,318
Incubator, W. Y. Cowl..... 337,308
Indicator. See Musical key indicator.
Inhalers, mixing and vaporizing device for, G. E. Johnson..... 337,066
Iron. See Smoothing iron.
Jack. See Jumping jack.
Joints, stop for expansion, J. B. White..... 337,087
Jumping jack, J. A. Kienardt..... 336,923
Key. See Extension key.
Knife sharpener, Shaw & Walden..... 337,023
Knob, door, E. Thistle... 337,093
Lamp burner, T. B. Willson..... 337,102
Lamp, electric arc, J. J. Wood..... 337,289
Lamp reservoir, W. P. Butler..... 337,302
Lamp shade, electric, P. H. Klein, Jr..... 337,336
Lamps, heating attachment for, S. H. Dibble..... 337,135
Land roller, Helm & Nickenich..... 337,264
Last, R. L. Campbell..... 337,131
Latch, night, Barnes & Woolaston..... 337,115
Leather stuffing, J. A. J. Shultz..... 337,287
Leg, artificial, R. C. Dunham..... 336,904
Lens tester, G. Johnston. 337,333
Lift or hoist, J. M. de Aguirre y Lizaola..... 337,049
Lifter. See Sash lifter. Transom lifter.
Lock. See Bicycle lock. Door lock. Nut lock. Trunk lock. Seal lock.
Lubricator. See Axle lubricator.
Manure pouch, T. M. McDonough..... 337,181
Map, chart, and bookcase, combined, D. D. Van Wie..... 337,095
Marker, land, A. T. Stewart..... 337,092
Matches, machine for making, Norris & Hagan.... 337,074
Measure, shoemaker's, A. S. Adler..... 337,039
Metal bars, machine for swaging, J. Berry..... 337,297
Metal wheels, mechanism for the manufacture of, J. R. Little..... 337,172
Meter. See Electric current meter.
Middlings purifier, C. N. Smith..... 337,207
Mill. See Grinding mill.
Mould. See Glassmaker's mould.
Moulding, cloth covered, J. Maxwell..... 337,008
Moulding machines, cutter for, H. C. Tunis..... 337,353
Mop wringer, D. Lynch..... 337,274
Motion, device for converting reciprocating into rotary, M. G. Adams..... 336,978
Motor. See Spring motor.
Mucilage bottle, W. H. Redington..... 336,945
Music strips, making, R. Butterworth..... 337,304
Musical key indicator, O. H. Goodwin..... 337,320
Nail capping machine, J. M. Ellis..... 336,994
Nut lock, J. M. Calendas..... 336,892
Oar, jointed boat, B. F. Bennett..... 336,886
Ore crusher, S. G. Rollins..... 337,085
Ores, etc., machine for concentrating, F. H. Blake..... 337,122
Organ stop action, combination, W. H. Price, Jr.. 337,348
Organs, pneumatic action for, I. Bassett..... 336,982
Organs, pneumatic action for, C. S. Haskell..... 337,326
Oven, W. Miller..... 336,937
Overalls, C. Erlanger..... 337,316
Ox shoes, die for trimming, J. Deeble..... 336,901
Ox shoes, manufacture of, J. Deeble..... 336,900
Package, cylindrical wooden, J. Tomlinson..... 336,963
Package for belt dressing compounds, J. H. Bringold..... 337,235
Packing, W. White, Jr..... 337,100
Packing for car axle boxes, E. Waite..... 336,966
Pad. See Blotting pad.
Paint exhibitor, T. C. Van Arsdale..... 337,034
Pan. See Ash pan.
Paper calendering machine, M. Solinger..... 337,028
Paper cutting machine, B. Sandmann..... 337,286
Paper, grease proof, D. Heston..... 337,155
Paper hangings, etc., exhibitor for, L. A. Ely..... 337,315
Paper machines, stock regulator for, C. Potter.... 337,080
Paper tubes, machine for making, M. D. Knowlton..... 337,165
Pattern lining, M. Stocker..... 337,030
Picking or ginning machines, doffing apparatus for, S. R. Parkhurst..... 337,014
Picture frame, G. H. Thonssen..... 337,033
Picture mats, etc., mechanism for the manufacture of, Caldwell & Smith... 337,129
Pill roller, J. D. Kutzner..... 337,342
Pin. See Connecting pin.
Pin rails, drum attachment for, A. F. Spear..... 337,029
Pipe. See Gas supply pipe.
Pipe connection, B. P. Bower..... 337,126
Plaiting machine, R. W. Henderson..... 336,999
Planter, corn, M. E. Doolittle..... 337,313
Planter, corn, J. W. Harbin..... 337,261
Planter, force feed seed, J. H. Keedy..... 337,268
Planter, lister corn, M. M. Holmes..... 337,156
Plow, F. Reyner..... 336,946
Plow, gang, J. J. Young..... 337,107
Plow, steam, G. Willard..... 336,969
Plow stock and cultivator combined, J. A. Lifsey. 337,069
Post. See Fence post.
Posts, base for, W. H. Kellogg..... 337,163
Pot. See Firepot.
Potato digger, J. H. Lewis..... 337,169
Potato sprinkler, W. H. Moore..... 336,938
Press. See Baling press. Household press.
Printer's galley, D. W. Whitaker..... 337,218
Puller. See Stump or stone puller.
Pulley, E. C. Sooy..... 336,958
Pulley, belt, F. Siebert..... 337,024
Pump, W. P. Andrews..... 337,040
Pump, J. M. Laing..... 337,167
Pump, J. M. Normand..... 336,940
Pump, centrifugal, W. O. Webber..... 337,216
Pump, chain, Tyler & Carter..... 337,354
Pumps, steam valve gear for duplex steam, J. S. Klein..... 336,924
Punch, Platts & Crane..... 337,077
Punch, clinching, J. R. Watson..... 337,036
Punching machine, R. H. Dowell..... 337,139
Quilting machine, M. H. Marcus..... 337,178
Rack. See Display rack. Hay rack.
Rafts and booms, plug for, T. Irvine..... 336,920
Railway crossing, M. A. Dilley..... 337,253
Railway gate, J. H. Pollard..... 337,079
Railway nut wrench, A. J. Forbes..... 336,908
Railway signaling apparatus, F. N. Kelsey..... 337,269
Railway switch stand, Brown & Meeker 336,988
Railway system, pendant car elevated, P. Hale.... 337,149
Railway time signal, C. Barry..... 337,229
Railway trains, revolving signal for, I. Rickard.... 337,288
Rake. See Hay rake. Horse rake.
Ram, hydraulic, A. Baer..... 337,112
Reclining chair, L. Davis..... 337,132
Recorder. See Car seat recorder.
Reel. See Belt reel. Carpet cleaning reel. Harvester reel.
Reel, J. M. Bannan..... 336,885
Refrigerator, E. S. Farson..... 337,256
Refrigerator, well, J. E. Grosjean..... 337,058
Regulator. See Electric machine regulator. Gas regulator.
Revolver, H. Schlund..... 337,201
Ring. See Curtain pole ring.
Rivet, E. Flagg..... 337,142
Roller. See Land roller. Pill roller.
Rotary engine, T. P. Coombs..... 336,896
Saddle, harness, P. W. Corcoran..... 337,047
Saddle, harness, W. S. Webster..... 337,217
Sash fastener, A. D. McCall..... 336,932
Sash lift, A. Wiggers..... 337,098
Saw setting and gumming tool, combined, D. McDonough..... 336,983
Saw tooth, W. B. Risdon..... 337,083
Saw tooth, C. J. Wilson..... 337,103
Scraper and brush, combined shoe, W. P. Manning..... 336,931
Screen. See Extension screen.
Seal lock, G. Koch..... 336,925
Seat. See Wagon seat. Washtub seat.
Secondary battery, C. F. Brush..... 337,298, 337,299
Separator. See Cockle and grain separator. Cream separator. Grain separator.
Sewing machine, boot and shoe, E. Adams..... 337,291
Sewing machine, buttonhole, J. W. Lufkin..... 337,273
Ships, apparatus for bending the ribs or frames of metallic, W. M. Bailey..... 337,113
Shirt, E. A. Krones..... 337,341
Shoe, seamless, A. Graff..... 336,913
Shoe, spring, J. Gluecksmann..... 337,146
Shutter fastener, F. A. S. Perry..... 337,076
Shutter, inside, R. Blair..... 337,121
Siding and roofing board, J. W. Crabbe..... 337,310
Sign, R. Nicol, Jr..... 337,188
Signal. See Railway time signal.
Signal horn, C. A. Volke..... 337,098
Signal or call box, Davis, Jr., & Gale..... 337,356
Skate, L. Hull..... 336,919
Skate, roller, J. B. Harris, Jr..... 337,151
Skate, roller, S. E. Shute..... 337,205
Skating, etc., means for the construction of surfaces for, J. A. Calantarients..... 337,128
Smoke conductor, T. Rundle, Jr..... 337,087
Smoothing iron, Kearns & Noble..... 337,267
Smut machine, S. Wohlrab..... 337,219
Snow plow, Ormerod & Croskey..... 337,075
Snow plow, J. M. Poitras..... 337,078
Soap, C. H. Walker..... 337,035
Soldering machine, can, D. M. Monroe..... 337,277
Spindle. See Spinning spindle.
Spinning spindle and bearing therefor, E. Dummer..... 336,903
Spoons, manufacture of, W. A. Warner..... 337,099
Spring. See Carriage spring. Vehicle spring.
Spring, J. H. Davis..... 337,048
Spring motor, H. E. Marchand..... 337,177
Sprinkler. See Potato sprinkler.
Squeezer and strainer, combined, J. Mikel..... 337,185
Squib, E. J. Cotter..... 337,307
Stalk cutter, J. H. Jones..... 337,335
Stamp, printing, H. Holt..... 337,331
Stand. See Railway switch stand. Switch stand.
Staple holding implement, C. E. Van Dusen..... 337,212
Steam boiler, Dougherty & Feeley..... 337,138
Steam boiler, sectional, R. R. Zell (r)..... 10,695
Steam engine, J. T. Metcalfe..... 337,184
Steam engine, fireless, M. Honigmann..... 337,062
Steam engine indicators, device for operating, J. R. Goddard..... 337,147
Steam generator, J. R. Moore..... 337,073
Steamboat stage, J. Patin..... 337,281
Stocking supporter, C. J. Haley..... 336,917
Stopper. See Bottle stopper.
Stopper fastener, F. W. Seymour..... 337,202
Stove lids, pattern for moulding, E. Evans..... 337,052
Stoves or ranges, plate joint for, N. A. Boynton... 337,127
Strawberry runner cutter, double, G. W. Love.... 337,174
Street sanding machine, B. Butler..... 337,300
String gauge, C. F. Albert..... 337,224
Stump or stone puller, T. B. Barber..... 337,114
Switch stand, A. A. Strom..... 337,352
Syringe, W. H. Conkle..... 337,249
Tacks, device for driving and bending headless, Higgins & Condit..... 337,061
Teakettle spout, J. W. Yates..... 337,977
Telegraph, duplex, B. E. J. Eils 337,314
Telegraphic relay, polarized, J. C. Ludwig..... 337,272
Telephone, S. Bergmann..... 337,231
Telphone, Edison & Bergmann..... 337,254
Telephone call, J. C. Wilson..... 336,972
Telephone receiver, S. Bergmann..... 337,232
Tire upsetter, W. M. Helms..... 337,265
Tool handle, J. Chantrell..... 337,242
Toy money box, J. H. Bowen..... 337,125
Train signaling apparatus, J. P. A. Hanlon *et al*... 337,260
Transom lifter, J. F. Wollensak..... 336,975
Trap. See Animal trap.
Tree feller and pile cutter, W. G. Rendall..... 337,018
Tricycle, F. White..... 336,968
Trousers stretcher, McIlvenna & Rollason..... 337,071
Truck, car, F. A. Bartholomew..... 336,983
Truck, traveling suspension, H. J. McArdle..... 337,179
Trunk, S. Hermann..... 337,328
Trunk lock, F. W. Mix.. 337,187
Truss, abdominal, C. Zimmer..... 337,290
Tube. See Paper tube.
Tube punching machine, C. P. Higgins..... 337,330
Tubes, forming serpentine, N. W. Pratt..... 337,282
Tubes, machine for sizing, straightening, and finishing, J. K. Davis..... 336,899
Tug, D. Hawn..... 337,263
Tug fastener, spring, L. H. Nusbaum..... 337,347
Tug, hame, J. T. Condon..... 337,248
Umbrella, P. Meyer, Jr..... 337,276
Umbrella casing, R. E. Ghezzi..... 337,145
Underwaist or strengthening corset for children, E. Nagle..... 337,280
Valve motion, J. S. Ash..... 337,293
Valve, relief, J. Briscoe..... 337,236
Valve, slide, C. H. Baker..... 336,980
Vegetable cutter, J. H. Fraumann..... 336,909
Vehicle brake, W. J. Devers..... 337,134
Vehicle curtain, J. E. Bimm..... 337,120
Vehicle dash frame, W. I. Atwood..... 337,294
Vehicle spring, C. H. Terry..... 337,208
Vehicle, two-wheeled, J. G. Gay..... 337,258
Velocipede, E. G. Latta..... 337,271
Veneering with fabric, G. Muller..... 337,346
Ventilating mines, apparatus for, Graves & Kingley..... 336,914
Ventilator. See Hat ventilator.
Violin bows, device for securing, C. F. Harrington..... 337,059
Vise jaws, die for making, C. Konold..... 337,339
Vise jaws, machine for making, C. Konold..... 337,340
Wagon seat, J. L. Hughes... 337,063
Washboard, G. P. Fuller..... 336,910
Washboard, E. L. Pridham..... 337,349
Washtub seat, C. H. Kelley..... 337,001
Washer. See Bottle washer.
Washing machine, D. G. Colbert..... 337,046
Washing machine, E. W. Dixon..... 337,136
Washing machine, D. D. Fredericks..... 337,144
Washing machine, A. Malcolm..... 336,930
Water closet cistern, J. Demarest..... 337,133
Water elevator, J. C. Davis..... 337,251
Water, purifying, H. H. Smith..... 337,026
Water supply system, C. H. Godfrey..... 336,997
Weather strip, T. J. Fitzpatrick..... 336,907
Weather strip for doors, A. J. Davis..... 337,250
Wheat and other grain, machine for peabling, J. J. Hubbell..... 337,160
Wheel. See Metal wheel. Wind wheel.
Wheel, S. T. Williams..... 337,229
Whiffletree evener spring casing, T. J. Christy.... 336,991
Whiffletree hook, F. Eggers..... 337,225
Winch, steam, A. J. Maginnis..... 337,175
Wind wheel, J. T. Thomson..... 337,094
Window, J. S. Pihlstrom..... 337,193
Wire cutter, D. Houghton..... 337,159
Wool drying machine, J. H. Lorimer..... 336,928
Wrench. See Railway nut wrench.
Wringer. See Mop wringer.

DESIGNS.

Carpet, D. G. Melville..... 16,554
Carpet, T. J. Stearns..... 16,557
Gimp, J. P. Boesen..... 16,552
Jewelry rack, C. Place..... 16,556
Rug, A. Petzold..... 16,555
Type, E. Lauschke..... 16,553

TRADE MARKS.

Ale, C. H. Evans..... 13,066
Battery used as a curative appliance for diseases of the eye, the ear, the nasal organs, etc., pocket, W. C. Wilson..... 13,081
Beer, lager, C. Conrad & Co..... 13,064
Bitters, T. Foulds & Son..... 13,067
Carpets, velvet, S. Sanford & Sons..... 13,080
Cigars, P. Gelpi & Bro..... 13,068
Corsets, ladies', Simpson, Crawford & Simpson..... 13,078
Dressing, polish, or blacking for shoes or leather, Button & Ottley..... 13,062
Flour, F. W. Smith..... 13,079
Flour, wheat, W. Lea & Sons Company..... 13,071
Hay, fodder, and straw cutters, Wilson Bros. & Co..... 13,082
Interment sacks, rubber, Goodyear Rubber Company..... 13,069
Jerseys, ladies', G. Schwab & Bros..... 13,077
Medicine for the cure of rheumatism, to be taken internally, W. H. Clewley..... 13,063
Medicine or condition powders, horse, J. L. Kreychie..... 13,070
Nails, wire, Albert Nail Company..... 13,060
Soap, hard, J. Reardon & Sons..... 13,076
Soap in cakes or bars, Dillern & Ackermann..... 13,065
Stove polish, Phœnix Plumbago Mining Company. 13,075
Tobacco, smoking and chewing, C. W. Allen Company..... 13,061
Type, printing, MacKellar, Smiths & Jordan Company..... 13,072
Wine, champagne, L. H. L. R. Oiry..... 13,073
Woolen fabrics, woven, S. B. Peabody..... 13,074

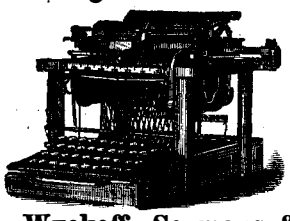
A printed copy of the specification and drawing of any patent in the foregoing list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 361 Broadway, New York. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

Canadian Patents may now be obtained by the inventors for any of the inventions named in the foregoing list, at a cost of $40 each. For full instruction address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Remington Standard Type-Writer



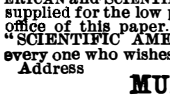
Purchasers permitted to return by Express C. O. D. for full purchase price at any time within thirty days, thus giving an opportunity for comparison with other machines.

Wyckoff, Seamans & Benedict,
339 Broadway New York.

A TREATISE ON STEAM BOILER INCRUSTATION and Methods for Preventing Corrosion and the Formation of Scale, including Methods for Determining the Constituents and a Description of Dr. Clark's Soap Test for Determining the Degree of Hardness of Water; the Effects of Rain, River, Well, and Sea Waters on Steam Boilers; Compounds and Apparatus for Purifying, Softening, Heating, Filtering, Spraying, and Separating Foreign Matter with from Mine, River, Well, and other Waters; Apparatus for Feeding Chemicals with the Water to Steam Boilers, and for Economizing in the Quantity of Water Consumed for Generating Steam in Places where the Supply of Water is Limited; Devices for Removing the Mud and Sediment and for Blowing off the Less Crystalline Substances and Salt from Steam Boilers; Including also a Description of Compounds for Softening Incrustations and Methods Claimed as Preventives to the Incrustation and Corrosion of Land and Marine Steam Boilers; also a Complete List of all American Patents Issued by the Government of the United States from 1790 to July 1, 1884, for Compounds and Mechanical Devices for Purifying Water and for Preventing the Incrustation of Steam Boilers. Illustrated by sixty-five engravings. By Charles Thomas Davis, author of "A Practical Treatise on the Manufacture of Bricks, Tiles, Terra-Cotta," etc. Price $2.00. A catalogue of books sent to all who will apply. Address MUNN & Co., 361 Broadway, New York City.

Syracuse Malleable Iron Works

PETROLEUM AS FUEL IN LOCOMOTIVE Engines. A paper by Thomas Urquhart.—How locomotives are arranged for burning petroleum. The spray injector. Storage of petroleum. Experimental engines and tenders. Results of comparative trials. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **455.** Price 10 cents. To be had at this office and all newsdealers.



$3 ELECTRIC BELT, Suspensory, etc., for Kidneys, Pain, Nervous and Weak. A TRUE CURATIVE. Pays agents big. Circulars free. FLETCHER & CO., Cleveland, Ohio.

MODERN BRONZE ALLOYS.—A PAper by P. F. Nursey, C.E., presenting some valuable data concerning such bronzes as are being usefully employed for engineering purposes. The bronze of the ancients. Composition of bronzes. Phosphor bronze and its applications. Silicium bronze. Manganese bronze. Delta metal. Phosphor-copper. Phosphor-manganese bronze. Phosphor-lead bronze. Phosphor-tin. Aluminum bronze. Silveroid. Cobalt bronze. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 465. Price 10 cents. To be had at this office and from all newsdealers.

THE RESOURCES OF ALASKA.—AN interesting paper by Frederick Schwatka. Timber lands. Yellow cedar and its value. The salmon industry and salmon canneries. Whale fishery. Scenery of Southeastern Alaska. The fur industry. Mineral resources, Agriculture. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

HELP WANTED. $50 A WEEK and expenses paid. Valuable outfit and particulars free. J. F. HILL & CO., Augusta, Maine.

STEAM CATAMARAN MAY BARrett.—Plans and specificationm of the catamaran May Barrett, a family cruising boat built for use on rivers and lakes. Construction of hulls, deck beams, main deck, upper works, engine and boiler, wheel. With 10 figures. Cotanined in SCIENTIFIC AMERICAN SUPPLEMENT, No. **472.** Price 10 cents. To be had at this office and from all newsdealers.

Woodworking Machinery.
For Planing Mills, Furniture and Chair Factories, Car and Agricultural Works, Carriage and Buggy Shops, and General Wood Workers. Manufact'd by
The Egan Company,
Cincinnati, O., U. S. A.
Full assortment of Perin Saw Blades.

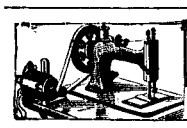
FRICTION CLUTCH
Pulleys and Cut-off Couplings.
JAS. HUNTER & SON. North Adams, Mass.

PERFUMES.—A PAPER BY JACOB Jesson, describing various articles used in perfumery, and the mode of preparing essences therefrom, stating the amount and cost of material required, and giving over thirty formulas for handkerchief extracts, with the cost of each. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **472.** Price 10 cents. To be had at this office and from all newsdealers.

Draftsman's Adjustable Curve Ruler, makes any shape curve, $1.50. F. W. DAVENPORT, Providence, R. I. Send for card.

PERFECT
NEWSPAPER FILE

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.
Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN.



© 1886 SCIENTIFIC AMERICAN, INC

A Great Repository of Practical and Scientific Information Indispensable to Every One.

In preparation. To be published June 1, 1886.

The Techno-Chemical Receipt Book.

Containing several thousand receipts, comprising the latest, most valuable, and most useful discoveries in Chemical Technology, the Arts, and the Industries. Edited chiefly from the German of Drs. Winckler. Elsner, Heintze, Mierzinski, and Jacobsen, with additions. By William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia; and William H. Wahl, Ph.D. (Heid.), Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated; in one volume, 12mo, 450 pages. *Price* $2.00, *free of postage to any address in the World.*

Subscriptions will now be received, payable on publication.

☞ *A prospectus, showing the contents of this important volume, now ready, and will be sent free to any one who will furnish his address to*

HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

THE IMPROVED
Rider Hot Air Pumping Engine
For City or Country Residences,
Burns Coal, Wood, or Gas. Safe, Simple, Durable. **3,000** in use. Send for Illustrated Catalogue "A."
SAYER & CO., 34 Dey St., New York.

LOOK **$10 Orgulnettes $6. Roll Music Reduced. Catalogue FREE.**
MAGIC LANTERNS WANTED; also FOR SALE.
HARBACH ORGAN CO., Phila., Pa.

THE CHEAPEST AND BEST PHOTO ENGRAVING Co. ENGRAVING FOR ALL ILLUSTRATIVE AND ADVERTISING PURPOSES.
67 Park Place New York

WORKSHOP RECEIPTS.

For the use of Manufacturers, Mechanics, and Scientific Amateurs. The best late collection published of such a wide variety of information.

FIRST SERIES.—Bookbinding; Candles; Drawing; Electro-Metallurgy; Engraving; Gilding; Japans; Photography; Pottery; Varnishing, etc. 450 pages, with illustrations, ... **$2.00**

SECOND SERIES.—Industrial Chemistry; Cements and Lutes; Confectionery, Essences, and Extracts; Dyeing, Staining, and Coloring; Gelatine, Glue, and Size; Inks; Paper and Paper Making; Pigments, Paint, and Painting, etc., ... **$2.00**

THIRD SERIES.—Alloys, Electrics, Enamels and Glazes, Glass, Gold, Iron, and Steel, Lacquers and Lacquering, Lead, Lubricants, Mercury, Nickel, Silver, Tin, Vanadium, Zinc, etc. 480 pages, 183 illustrations, . **$2.00**

FOURTH SERIES.—Waterproofing; Packing and Storing; Embalming and Preserving; Leather Polishes; Cooling Air and Water; Pumps and Siphons; Desiccating; Distilling; Emulsifying; Evaporating; Filtering; Percolating and Macerating; Electrotyping; Stereotyping; Bookbinding; Straw-plaiting; Musical Instruments; Clock and Watch Mending; Photography, etc. **$2.00**

☞ Send for our complete Catalogue of books, free to any address.

☞ In ordering single volumes, be particular to mention the "series" wanted.

Sent postpaid by **MUNN & CO., 361 Broadway, New York,** on receipt of price.

FOREIGN PATENTS.

Their Cost Reduced.

The expenses attending the procuring of patents in most foreign countries having been considerably reduced the obstacle of cost is no longer in the way of a large proportion of our inventors patenting their inventions abroad

CANADA.—The cost of a patent in Canada is even less than the cost of a United States patent, and the former includes the Provinces of Ontario, Quebec, New Brunswick, Nova Scotia, British Columbia, and Manitoba.

The number of our patentees who avail themselves of the cheap and easy method now offered for obtaining patents in Canada is very large, and is steadily increasing.

ENGLAND.—The new English law, which went into force on Jan. 1st, 1885, enables parties to secure patents in Great Britain on very moderate terms. A British patent includes England, Scotland, Wales, Ireland and the Channel Islands. Great Britain is the acknowledged financial and commercial center of the world, and her goods are sent to every quarter of the globe. A good invention is likely to realize as much for the patentee in England as his United States patent produces for him at home, and the small cost now renders it possible for almost every patentee in this country to secure a patent in Great Britain, where his rights are as well protected as in the United States.

OTHER COUNTRIES.—Patents are also obtained on very reasonable terms in France, Belgium, Germany, Austria, Russia, Italy, Spain (the latter includes Cuba and all the other Spanish Colonies), Brazil, British India, Australia, and the other British Colonies.

An experience of FORTY years has enabled the publishers of THE SCIENTIFIC AMERICAN to establish competent and trustworthy agencies in all the principal foreign countries, and it has always been their aim to have the business of their clients promptly and properly done and their interests faithfully guarded.

A pamphlet containing a synopsis of the patent laws of all countries, including the cost for each, and othe information useful to persons contemplating the procuring of patents abroad, may be had on application to this office.

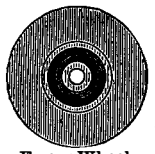
MUNN & CO., Editors and Proprietors of THE SCIENTIFIC AMERICAN, cordially invite all persons desiring any information relative to patents, or the registry of trade-marks, in this country or abroad, to call at their offices, 361 Broadway. Examination of inventions, consultation, and advice free. Inquiries by mail promptly answered.

Address, **MUNN & CO.,**
Publishers and Patent Solicitors,
361 Broadway, New York.

BRANCH OFFICES: No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

NOVELTY ELECTRIC CO.
Store and Factory: 5th and Locust Sts., Philadelphia.
Everything Electrical.

NEW YORK BELTING AND PACKING COMP'Y.
The Oldest and Largest Manufacturers of the Original
SOLID VULCANITE Emery Wheels.



Emery Wheel.
JOHN H. CHEEVER, Treas.
J. D. CHEEVER, Dep'y Treas.

All other kinds Imitations and Interior. Our name is stamped in full upon all our standard **BELTING, PACKING,** and **HOSE.** Address
NEW YORK BELTING & PACKING CO.
Warehouse: 15 Park Row, opp. Astor House, New York.
Branches: 308 Chestnut St., Phila., 167 Lake St., Chicago, 52 Summer St., Boston.

ICE. REFRIGERATING and Ventilating Machines Jarmans Patent. **YORK MFG. CO., York, Pa.**

RESERVOIRS.

The only absolutely water-tight reservoirs for towns and cities; also acid-proof reservoirs. For description send to T. NEW, 32 John Street, New York.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29. ST. NEW YORK CITY

WOOD & PHOTO ENGRAVING JOHN W. CAUGHEY PITTSBURGH PA
IT PAYS TO GET THE BEST SEND COPY WITH STAMP FOR ESTIMATE NO MATTER HOW FAR DISTANT.

SANITARY EXAMINATION OF DRINKing Water.—By Prof. E. R. Angell. The odor of water and how to detect it. Tests and their applications. Nitrates and Nitrites. Lead and iron. Test for lead. Tests for organic matter. A valuable paper. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **462.** Price 10 cents. To be had at this office and from all newsdealers.

SEAMLESS BRASS & COPPER TUBES. SHEET BRASS BRASS WIRE. FINE TOOLS FOR TAPS. SEND FOR CATALOGUE. 175-177 LAKE ST. CHICAGO.

Mention this paper.

PROPOSALS,

To Furnish Silk Reeling Machines of the Most Modern and Best Patterns.

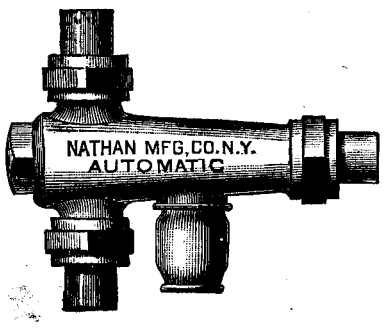
PROPOSALS AND CORRESPONDENCE to be accompanied with drawings or photographs of machines; also price. Address proposals to the
STATE BOARD OF SILK CULTURE,
21 Montgomery Ave., San Francisco, Cal.

ACETYLENE.—CHEMICAL COMposition, Properties, mode of preparation, with 2 engravings of apparatus. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

POINTERS for Users of Steam Pumps.
Van Duzen's Patent Steam Pump
Can Pump { Hot or Cold. / Sandy or Impure / Water or Liquids. } Is Efficient.
Has no moving parts, consequently no wear, no repairs, no trouble. Purchasers assume no risks, as we guarantee every Pump. Above comparison with Jet Pumps, Ejectors, etc., made of Iron. Demand this Pump of your dealer and take no cheap substitute. We make Ten Sizes. Prices from $7 to $75. Capacities from 100 to 20,000 gallons per hour. State for what purpose wanted and send for Catalogue of "Pumps."
VAN DUZEN & TIFT, Cincinnati, O.

PORTABLE BRIDGES.—DESCRIPtion of a novel system of portable bridges devised by Mr. Alfred Cottrau, of Naples. Illustrated with 14 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **466.** Price 10 cents. To be had at this office and from all newsdealers.

THE NEW "GRESHAM" PATENT



Automatic Re-Starting Injector.

Invaluable for use on Traction, Farm, Portable, Marine, and Stationary Engines of all kinds. No Handles required. Water Supply very difficult to break. Capability of restarting immediately, automatically, after interruption to feed from any cause. Reliable and Cheap.

Sole Manufacturers in the United States and Canada,

Nathan Manufacturing Co.,
92 & 94 LIBERTY ST., N. Y.

MINING AND HOISTING
Machinery; also, **Stationary Engines, Boilers, and Ventilating Fans.** Estimates made and contracts taken for constructing all kinds of Mining Machinery.
I. A. FINCH & CO., BOX 335, SCRANTON, PA.

DOUBLE BOATS.—TWENTY-ONE ILlustrations of patented double boats, the general construction and plan of which are so clearly shown as to need no detailed description. Name of patentee and date of patent accompanying each diagram. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **232.** Price 10 cents. To be had at this office and from all newsdealers.

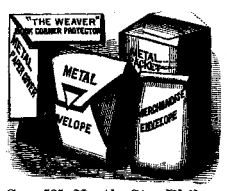
I. W. COLBURN & Co. FITCHBURG, MASS. 200 MAIN ST. LOWEST LIVING PRICES! ARC AND INCANDESCENT LIGHTING AND PLATING MACHINES.

THE NATIONAL TRANSIT COMpany's Pipe Lines for the Transportation of Petroleum to the Seaboard. Discovery of petroleum. Former modes of transportation. The origin of pipe lines. General description of the longest line in use. Illustrated with map and profiles. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

AGENTS wanted to sell Territory or State rights under patent No. 316,593 on Ventilated Flour Chest, needed in every household. Liberal commission. Address MRS. M. WRIGHTMAN, Harper, Kas.

GOLD MEDAL, PARIS, 1878.
BAKER'S
Breakfast Cocoa.
Warranted *absolutely pure Cocoa,* from which the excess of Oil has been removed. It has *three times the strength* of Cocoa mixed with Starch, Arrowroot or Sugar, and is therefore far more economical, *costing less than one cent a cup.* It is delicious, nourishing, strengthening, easily digested, and admirably adapted for invalids as well as for persons in health.
Sold by Grocers everywhere.
W. BAKER & CO., Dorchester, Mass.

THERAPEUTICAL EFFECT OF THE Internal Administration of Hot Water in the Treatment of Nervous Diseases.—By Ambrose L. Ranney, M.D. Rules for administration. The effects of the treatment. Theory of the action of hot water. Points in its favor. Conclusions. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **463.** Price 10 cents. To be had at this office and from all newsdealers.



Save postage by using Weaver Metal Mailing Boxes and Envelopes, Book Corner Protectors, metal, paper covered. For sending merchandise of every description through the U. S. and Foreign mails. Approved by P. O. Dept. Cheapest, lightest, strongest. No lids. No strings. 50,000 sizes. Send for sample and prices to Weaver Mailing Envelope & Box Co., 525 North St., Phila. A. De O. ROSSITER, Sole Lessee.

UNIVERSAL ANTI-THILL RATTLER.

Patented. Instantly applied with the fingers, without removing the shafts or wheels. Tension screw to take up wear. Never break or work out of place. By mail, **25 cts.** per pair. Trade supplied.
HARTFORD RUBBER WORKS, Hartford, Ct.

BEFORE YOU BUY A BICYCLE
Of any kind, send stamp to **A. W. GUMP, Dayton, Ohio,** for large Illustrated Price List of NEW and SECOND-HAND MACHINES. Second-hand BICYCLES taken in exchange.
BICYCLES Repaired and Nickel Plated.

VOLNEY W. MASON & CO.,
FRICTION PULLEYS CLUTCHES and ELEVATORS,
PROVIDENCE, R. I.

THE AMERICAN OIL AND GAS Fields.—A general account of the petroleum industry in America, by Pros. James Dewar, F.R.S. Tracts where oil is found. Manner of obtaining oil. Relations of gas to oil. Analyses of oil gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **498.** Price 10 cents. To be had at this office and from all newsdealers.

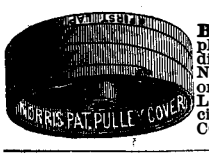
FREE TO MEN Who suffer from **Nervous Debility,** *Lost Vigor, Exhausted Vitality, etc.*
A FREE TRIAL PACKAGE
Of the celebrated MARSTON BOLUS, together with *Sealed Treatise* and Testimonials, will be sent on receipt of 2 stamps.
MARSTON REMEDY CO., 46 West 14th Street, New York.

THE DESIGNING OF ORDINARY **IRON HIGHWAY BRIDGES,** Illustrated by Numerous Engravings and 7 Folding Plates. Showing Bridges Actually Constructed, and Giving Their Dimensions; also containing 42 Tables. Price, $4.00. By J. A. L. WADDELL, C.E., B.A.Sc., M.A.E. The very complete index will prove of great convenience to both students and engineers, using the work as a book of reference. Address, MUNN & CO., 361 Broadway, New York.

The New Catalogue of Valuable Papers
contained in SCIENTIFIC AMERICAN SUPPLEMENT, sent *free of charge* to any address.
MUNN & CO., 361 Broadway, N. Y

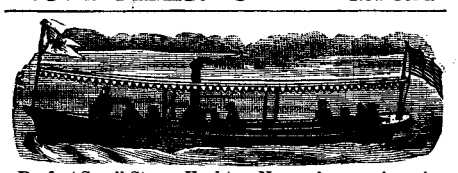
OTTO GAS ENGINE.

GUARANTEED TO CONSUME 25 to 75 PER CENT. LESS GAS THAN ANY OTHER GAS ENGINE Per BRAKE-HORSEPOWER
SCHLEICHER, SCHUMM & CO., PHILADELPHIA and CHICAGO.



Sure Cure for Slipping Belts. Rubber and Canvas. Applied spirally (see cut) without disturbing pulley or shafting. Not affected by heat, moisture, or dust. Saves Power, Belts, Lacing and Journals. Write for circular "B." MILMO COTTON CO., 295 Church St., New York.

DRAWING INSTRUMENTS. Illustrated catalogue sent on application to WM. T. COMSTOCK, 6 Astor Place, New York.

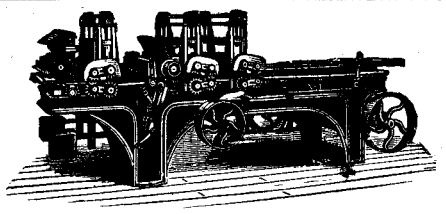


Perfect Small Steam Yachts. No smoke or noise, simple, safe; fuel, water gas; 3 cylinder engines. Send stamp for either yacht or boat catalogue.
THOMAS KANE & CO., Racine, Wis., Chicago, Ill.

Especially for **MILLER'S** Steam Hammers. Unequaled for water packing, and for oil pumps. In rope form of all sizes, ⅛, ¼, ⅜, ½, ⅝, ¾, ⅞, 1", etc. All quantities, $1.25 per lb. *It is the most substantial ever put together!* none out—add a round Packing material whenever there is room for it. MILLER PACKING WORKS, Pack with it—take 1338 Buttonwood St., Philadelphia, Pa., U. S. A.

CABLED Trade Mark **PACKING.**

ICE-HOUSE AND REFRIGERATOR. Directions and Dimensions for construction, with one illustration of cold house for preserving fruit from season to season. The air is kept dry and pure throughout the year at a temperature of from 34° to 36°. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **116.** Price 10 cents. To be had at this office and of all newsdealers.



WITHERBY, RUGG & RICHARDSON, Manufacturers of Patent Wood Working Machinery of every description. Facilities unsurpassed. Shop formerly occupied by R. Ball & Co., Worcester, Mass. Send for Catalogue.

2½c. **PULLEYS** ORDER FROM OUR "SPECIAL LIST." **4c.**
ROUGH THE John T. Noye Mfg. Co. BUFFALO, N. Y. **FINISHED**

DEAFNESS its CAUSES and CURE, by one who was deaf twenty-eight years. Treated by most of the noted specialists of the day with no benefit. *Cured himself* in three months, and since then hundreds of others by same process. A plain, simple and successful home treatment. Address T. S. PAGE, 128 East 26th Street, New York City.

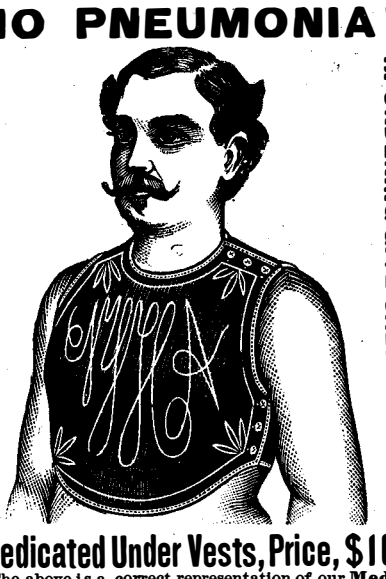
CURE FOR THE DEAF
PECK'S PATENT IMPROVED CUSHIONED EAR DRUMS **Perfectly Restore the Hearing,** and perform the work of the natural drum. Invisible, comfortable and always in position. All conversation and even whispers heard distinctly. Send for illustrated book with testimonials, **FREE.** Address F. HISCOX, 853 Broadway, N. Y.

PILES. Instant relief. Final cure in 10 days, and never returns. No purge, no salve, no suppository. Sufferers will learn of a simple remedy, Free, by addressing C. J. MASON, 78 Nassau St., N. Y.

TO WEAK MEN suffering from the effects of youthful errors, early decay, lost manhood, etc. I will send a valuable treatise (sealed) containing full particulars for home cure, free of charge. Address Prof. F. C. FOWLER, Moodus, Conn.

WEAK MEN!
Whose **VITALITY** is failing, Brain **DRAINED** and **EXHAUSTED** or Power **PREMATURELY WASTED** may find a perfect and reliable cure in the
FRENCH HOSPITAL REMEDIES
originated by Prof. JEAN CIVIALE, of Paris, France, adopted by all French Physicians and being rapidly and successfully introduced here. All weakening losses and drains promptly checked. **TREATISE** giving newspaper and medical endorsements, c., **FREE.** Consultation (office or by mail) with six eminent doctors **FREE.**
CIVIALE AGENCY, No. 174 Fulton Street, New York

NO PNEUMONIA!



RECOMMENDED BY PHYSICIANS. **IN ORDERING GIVE CHEST MEASURE.**

Medicated Under Vests, Price, $10.
The above is a correct representation of our **Medicated Under Vest,** to be worn next to the skin, and which has proven itself to be the very **Perfection of Prevention from Pneumonia.** The outside is of fine, light or medium weight felt, with woolen lining of material such as will allow the medicated powder, a thin layer of which is quilted in, to come in contact with the skin in such fine quantity as to keep up a very gentle and pleasant counter irritation, keeping the skin in a most delicious and healthy glow and the internal organs in that healthy and vigorous condition which is the **Only Safeguard Against Disease.**
NEW YORK HEALTH AGENCY
285 BROADWAY, NEW YORK.
Sent by Mail on receipt of price. Send for Circular.

© 1886 SCIENTIFIC AMERICAN, INC

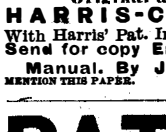
Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

A PLAIN BRACE, A RATCHET BRACE, A DRILL BRACE, ALL IN ONE. Material, Style, Finish, Durability, in all respects this Brace is warranted to be the best in any market. Sent by mail, postage paid by us on receipt of $3.00. Most Hardware dealers will furnish it at the same price. MILLERS FALLS CO. No. 74 Chamber St., New York.

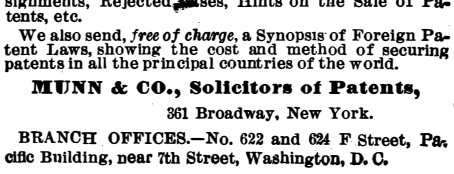
THE WALL.—A LECTURE BY PROF. T. R. Smith, F.R.I.B.A. Physical Qualities and Mode o Constructing. Walls of the Middle Ages. Egyptian, Grecian, and Roman Walls. Different ways of dealing with a Wall. Masonry of the Jews. Ornamentation. Color. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **466.** Price 10 cents. To be had at this office and from all newsdealers.



Andrews' Office & Bank Desks
The finest work in the U. S.; kiln dried lumber. All work guaranteed. OPERA CHAIRS, School Desks, Globes.
A. H. Andrews & Co. 195 Wabash-av. Chi. 19 Bond-st. New Y.

Leffel Water Wheels,
With Important Improvements.
11,000 IN SUCCESSFUL OPERATION.
FINE NEW PAMPHLET FOR 1885
Sent free to those interested.
JAMES LEFFEL & CO.,
Springfield, Ohio.
110 Liberty St., N. Y. City.

ENGINEERING PROGRESS IN 1884.—Report of the 13th Annual Convention of the American Society of Civil Engineers. Contained in SCIENTIFIC AMERICAN SUPPLEMENT NO. **498.** Price 10 cents. To be had at this office and from all newsdealers.



ICE-BOATS — THEIR CONSTRUCTION and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

MODEL and EXPERIMENTAL WORK —A— **SPECIALTY.**
Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

REPAIR OF BOILER TUBES.—BY F. W. Eichholz. A very valuable paper. How to repair leaky tubes. How to remove worn-out tubes. How to repair tubes in service, and put them in place again. Illustrated with 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **467.** Price 10 cents. To be had at this office and from all newsdealers.

Established 1832.
BRADLEY'S
Upright Cushioned
Helve Hammer
Combines all the best elements essential in a first-class hammer.
BRADLEY & CO.,
Syracuse, N. Y., U. S. A.

ENGINEER'S POCKET BOOK. BY Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form. Price $4. This valuable work will be sent on receipt of price by MUNN & CO., New York.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
FINE TINNING JAPANNING AND FINISHING
THOMAS DEVLIN & CO
LEHIGH AVE & AMERICAN ST. PHILA

DRAINAGE.—A SERIES OF VERY excellent directions for draining railways, roads, etc., by Mr. Charles Paine. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **468.** Price 10 cents. To be had at this office and from all newsdealers.

WM. A. HARRIS,
Providence, R. I. (Clark St.) Six minutes' walk West from station.
Original and Only Builder of the
HARRIS-CORLISS ENGINE,
With Harris' Pat. Improvements, from 10 to 1,000 H. P
Send for copy Engineer's and Steam User's Manual. By J. W. Hill, M.E. Price $1.25.
MENTION THIS PAPER.

PATENTS.

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty one years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

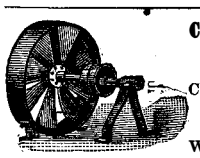
MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

RUBBER BELTING, PACKING, HOSE,
AND ALL OTHER KINDS OF
RUBBER GOODS,
FOR
MECHANICAL AND MANUFACTURING PURPOSES.
The Largest and Most Extensive Manufacturers in America.
THE GUTTA PERCHA AND RUBBER MFG. CO.,
New York, Chicago, San Francisco, Toronto.

PATENT
JACKET KETTLES,
Plain or Porcelain Lined. Tested to 100 lb. pressure. Send for Lists.
HAND, BARR & CO.,
614 and 616 Market St., Philadelphia, Pa.

THE DINGEE & CONARD CO'S
BEAUTIFUL EVER-BLOOMING
ROSES
Our Great Specialty is growing and distributing **ROSES.** We have all the latest novelties and finest standard sorts, in different sizes and prices to suit all wants. Over **450** *choicest varieties* to choose from. We send strong Pot Roses safely by mail to all Post Offices, purchaser's choice of varieties, all labeled, **3 TO 12 PLANTS $1.** $8 to $15 per Hundred, according to value. Two year Roses by express. Our **New Guide,** 78 pages, elegantly illustrated, **Free.** Address **THE DINGEE & CONARD CO.,** Rose Growers, **West Grove, Chester Co. Pa.**



CLARK'S DRYING, VENTILATING and EXHAUST FANS.
Cheapest. Most Effective.
Price List Free.
GEO. P. CLARK,
Windsor Locks, Conn. (Box L.

HIGH EXPLOSIVES FOR WAR PURposes.—A paper by Prof. C. E. Munroe, U.S.N.A., discussing some recent experiments on the use of high explosives for war purposes. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **474.** Price 10 cents. To be had at this office and from all newsdealers.

H. W. JOHNS'
ASBESTOS
Roofing, Building Felt,
Steam Packings, Boiler Coverings,
Fire Proof Paints, Cements, Etc.
Samples and Descriptive Price Lists Free.
H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.
175 Randolph St., Chicago; 170 N. 4th St., Philadelphia.

ROCK BREAKERS AND ORE CRUSHERS.
We manufacture and supply at short notice and lowest rates, Stone and Ore Crushers containing the invention described in Letters Patent. issued to Eli W. Blake. June 15th. 1858, together with NEW AND VALUABLE IMPROVEMENTS, for which Letters Patent were granted May 11th and July 20th, 1880. to Mr. S. L. Marsden All Crushers supplied by us are constructed under the superintendence of Mr. Marsden, who, for the past twenty years, has been connected with the manufacture of Blake Crushers in this country and England.
FARREL FOUNDRY AND MACHINE CO., Manufrs., Ansonia, Conn.
COPELAND & BACON, Agents, New York.

HARRISON CONVEYOR!
For Handling **Grain, Coal, Sand, Clay, Tan Bark, Cinders, Ores, Seeds, &c.**
Send for Circulars. | **BORDEN, SELLECK & CO.,** {Sole Manu'fers,} **Chicago, Ill.**

For ROOFS OF ALL DESCRIPTIONS, steep or flat, can be applied by ordinary workmen having no previous experience. Send for Samples and Illustrated Pamphlet. Address
W. H. STEWART,
74 Cortlandt Street, New York.
IRON-FIBRE PAINT, for Roofs and Factory and Farm Buildings.

GLYCERINE AND ITS USES.—A valuable and interesting paper by F. H. Alcock. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **496.** Price 10 cents. To be had at this office and from all newsdealers.

Columbia Bicycles and Tricycles.
Reduction in Prices and Many Improvements for 1886.
New Spring Catalogue Sent Free.
The POPE MFG. CO., 597 Washington St., Boston
Branch Houses: 12 Warren St., New York; 115 Wabash Ave., Chicago.

PORTLAND CEMENT.—THE SCIence and Art of the Manufacture of Portland Cement, with observations on some of its constructive applications. By Henry Reid, C.E., author of "A Practical Treatise on Concrete," etc. 8vo, cloth. Price $7.25. Address MUNN & Co., 361 Broadway, New York.

SLATE ROOF COVERINGS.—BY JOHN Slater. Characteristics of good slate, sizes of slate, laying slate. Contained in SCIENTIFIC AMERICAN SUPPLEMENT No. **498.** Price 10 cents. To be had at this office and from all newsdealers.

EVAPORATING FRUIT
Full treatise on improved methods, yields, profits, prices and general statistics, FREE.
AMERICAN MAN'F'G CO.
P. O. BOX R. **WAYNESBORO, PA.**

INTERNATIONAL INSTITUTE FOR
Liquefied Carbonic Gas.
O. BRUNLER, 857 Broadway, New York.

Transmission of Power.
Suspension Bridges,
Tramways,
and other applications of
WIRE ROPE
Trenton Iron Co.
WORKS and OFFICE, TRENTON, N. J.
New York Office—COOPER, HEWITT & Co., 17 Burling Slip. Philadelphia Office—21 North Fourth Street. Chicago Office—146 Lake Street.

FOOT OR POWER LATHES FOR WOOD OR METAL.
All sizes. Catalogues free. Lathes on trial.
SEBASTIAN, MAY & CO.,
165 West 2d Street, Cincinnati, O.

AMERICAN MECHANICAL DICTIONARY. A Descriptive Word Book of Tools, Instruments, Machines, Chemical and Mechanical Processes; Civil, Mechanical, Railway, Hydraulic, and Millitary Engineering; a History of Inventions; General Technological Vocabulary; and Digest of Mechanical Appliances in Science and Industrial and Fine Arts. Illustrated with upward of 7,000 engravings. By Edward H. Knight, A. M., Civil and Mechanical Engineer. In three octavo volumes. The set, cloth, $24.00; sheep, $27.00. For sale by MUNN & Co., 361 Broadway, New York City.

JENKINS BROS.' VALVES,
Gate, Globe, Angle, Check, and Safety.
MANUFACTURED OF BEST STEAM METAL.
The Jenkins Disks used in these Valves are manufacture under our 1880 Patent, and will stand any degree of steam pressure, hot and cold oils, or acid.
To avoid imposition, see that valves are stamped "Jenkins Bros."
JENKINS BROS.,
71 John St., New York. 13 So. Fourth St., Phila. 79 Kilby St., Boston.

Best and most reliable Belt ever introduced. Made by **C. A. SCHIEREN & CO.** 47 Ferry Street, New York; 416 Arch Street, Philadelphia; 86 Federal Street, Boston.

Barnes' Foot-Power Machinery.
Complete outfits for Actual Workshop Business. Read what a customer says: "Considering its capacity and the accurateness of your No. 4 Lathe, I do not see how it can be produced at such low cost. The velocipede foot-power is simply elegant. I can turn steadily for a whole day and at night feel as little tired as if I had been walking around." Descriptive Catalogue and Price List Free. W. F. & JOHN BARNES Co. Address 1999 Main St., Rockford, Ill.

THE AMERICAN BELL TELEPHONE CO.
95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30th, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones not furnished by it or its licensees responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

PROSPECTUS
OF THE
Scientific American
FOR 1886.
The Most Popular Scientific Paper in the World.

Only $3.20 a Year, including Postage. Weekly 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in the SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of the SCIENTIFIC AMERICAN will be supplied *gratis for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate.

The safest way to remit is by Postal Order. Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
361 Broadway New York.

THE Scientific American Supplement.

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology. Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information pertaining to these and allied subjects is given, the whole profusely illustrated with engravings.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are represented and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States and Canada, $5.00 a year, or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year for $7.00. Address and remit by postal order. express money order, or check,

MUNN & Co., 361 Broadway, N. Y.,
Publishers SCIENTIFIC AMERICAN.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, one year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for one year. This includes postage, which we pay. Remit by postal or express money order, or draft to order of

MUNN & CO., 361 Broadway, New York.

PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO'S INK. Tenth and Lombard Sts. Phila., and 47 Rose St., opp. Duane St., N Y.

© 1886 SCIENTIFIC AMERICAN, INC